



Landwirtschafts-
kammer
Schleswig-Holstein

Test report

Comparison of different container types used in tree nurseries

Trial: B 244-15A
Test years: 2015 - 2016

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1. Introduction

The amount of container-grown woody plants in tree nurseries is increasing. Tree nursery owners can choose from a wide variety of containers. Besides “standard containers” (plant pots), there are special systems, such as the Superroots Air-Pot® (hereinafter abbreviated to Air Pot), which should lead to a particularly healthy root development, and the so called “Root Pouch”, a tree bag which also exhibits good qualities in this regard.

In 2015 and 2016, on behalf of Drehandel GmbH (10245 Berlin, D) and Root Pouch (Hillsboro, Oregon 97124, USA), the Schleswig-Holstein Chamber of Agriculture - Department of Horticulture in Ellerhoop performed a planting trial.

2. Test execution: methods and materials

2.1. Experimental approach

Are there any differences between planting a *Tilia cordata* “Greenspire” in a Root Pouch tree bag (39 l), in a standard container (40 l), or in an Air Pot (37 l)?

2.2. Trial variants and structure

Guidelines: the trial was carried out following the principles of Good Experimental Practice.

Trial variants: Tab 1 shows the tested variants.

Tab 1: *Tilia cordata* “Greenspire” in various container types

Variant	Container Type	Pot volume
1	Standard container	40 l
2	Root Pouch	39 l
3	Air Pot	37 l

Test setup: Completely randomized block design with four replicates (a-d) (Fig 1-6).

Site plan: The spatial distribution of the test plants in the 3 variants, replicates a to d (Fig 1).

1a	1a	1a	1a	1a	1a	1a	1a	1a	1a	S e q u e n c e
2a	2a	2a	2a	2a	2a	2a	2a	2a	2a	
3a	3a	3a	3a	3a	3a	3a	3a	3a	3a	
2b	2b	2b	2b	2b	2b	2b	2b	2b	2b	
1b	1b	1b	1b	1b	1b	1b	1b	1b	1b	
3b	3b	3b	3b	3b	3b	3b	3b	3b	3b	
3c	3c	3c	3c	3c	3c	3c	3c	3c	3c	
1c	1c	1c	1c	1c	1c	1c	1c	1c	1c	
2c	2c	2c	2c	2c	2c	2c	2c	2c	2c	
3d	3d	3d	3d	3d	3d	3d	3d	3d	3d	
2d	2d	2d	2d	2d	2d	2d	2d	2d	2d	
1d	1d	1d	1d	1d	1d	1d	1d	1d	1d	

Fig. 1: Site plan of the 120 high-stem *Tilia* “Greenspire” in the standard container type (1), Root Pouch (2) and Air Pot (3), replicates a to d.



Fig. 2: Test setup of *Tilia cordata* “Greenspire” plantation in different container systems on 03/25/2015, Department of Horticulture - Schleswig-Holstein Chamber of Agriculture in Ellerhoop.



Fig. 3: Test setup of *Tilia cordata* "Greenspire" plantation in different container systems on 06/01/2015, Department of Horticulture - Schleswig-Holstein Chamber of Agriculture in Ellerhoop.



Fig. 4: Test setup of *Tilia cordata* “Greenspire” plantation in different container systems on 11/09/2015, Department of Horticulture - Schleswig-Holstein Chamber of Agriculture in Ellerhoop.



Fig. 5: Test plants at the beginning of May 2016 after overwintering, cut-back, terminal shoot shortening and 180 cm trimmed top.



Fig. 6: *Tilia cordata* “Greenspire” at the end of the trial period, mid-November 2016. After 2 years of cultivation time the trees have mostly grown to a stem girth of 12-14 cm independently from the container type

Feature recording:

The recorded features are listed in Tab. 2.

Tab. 2 Growth characteristics registered during the trial

No.	Feature	Unit	Date
1	Growth, color of the foliage and damage	Mark 1-9 ^{a)}	Every 14 days since the bud break
2	Stem diameter	mm	
3	Appearance grading FLL ^{b)} (Stem diameter)	cm	Nov 2015 + 2016
4	Terminal shoot length	cm	Nov 2015 + 2016
5	Total shoot length (this year's shoot > 10 cm)	m	Nov 2015 + 2016
6	Shoot fresh weight	g	Nov 2015 + 2016
7	Root development (number of roots that grow circularly at least 20 cm root-ball. Evaluation of a 5 cm long section from the west and east side of each container)	n + photos	Nov. 2015 + 2016
8	Circling roots growth (roots outside the root-ball)	Mark 1-9	Nov. 2015 + 2016
9	Substrate temperature (Root Pouch + Standard container)	°C	Continuous (Jun 2015 - Nov 2016)
10	Air temperature / rainfall	°C/mm	Continuous

^{a)} Mark 1: very low; 3= low; 5= average; 7= high; 9= very high

^{b)} FLL (2004): Quality regulations for tree nurseries, 3rd edition, Forschungsgesellschaft Landschaftsentwicklung Landschaftsbau, Bonn. page 60

2.3. Test plants and plantation

Variety: High-stem *Tilia cordata* "Greenspire" repotted twice, 6 to 8 cm

Cultivation: Tree nursery cultivation, two-year-long avenue tree cultivation in container

Quantity: - 120 plants in 2015, 40 plants per variant = 4 replicates per 10 plants.

- Only 58 plants in 2016, 20 plants per variant = 4 replicates per 5 plants. 2 Root Pouch plants were removed and brought to IPM fair, only 18 trees remaining

Positioning: Single row, plants set in rack, nurtured with 4 m tonkin canes

Pot distance: 0.6 m

Row distance: 0.7 m

Substratum: turf based substratum, turf (30%), Lecadan 2-4 mm (20%), wood fibers (15%), clay (40 kg/m²), Radigen (100 g/m²), horn shavings (2 kg/m²), pH 5.8

Watering: Drip irrigation, suction tension and tension meter management

Fertilization: - 2016 Osmocote Exact Standard 15-9-11+2MgO+TE 8-9M, 4 g/l, mixed in the substratum before planting

- 2017 per Container 160 g Osmocote Topdress FT 4-5M 22-5-6 + 5 MgO + TE, strewed on the substratum surface

Overwintering: No particular protection on the container's cultivation area, the containers were pushed side by side

Plant protection: Methods in general use

On 09/01/2015 Karate Forst (Lambda-cyhalothrin) against willow sawfly and Mirage 45 EC (Prochloraz), against plant-leaf spots causing fungus. No measures were necessary in 2016

Evaluation: Interim evaluation on 11 November 2015, final evaluation on 11/19/2016

2.4. Experimental site

Address: Landwirtschaftskammer Schleswig-Holstein – Department of Horticulture, Thiensen 16, 25373 Ellerhoop

Testing area: Container culture C 15

Winter hardiness zone: 7b - 8a

3. Weather conditions at the test site

The described values (Fig. 4 and 5) originate from the weather station of the Schleswig-Holstein Chamber of Agriculture's Department of Horticulture in Ellerhoop.

3.1. Weather conditions in the test year 2015

The year 2015 was characterised by strong droughts in February and April. Even though precipitations in May and June were average, they were too strong in June and August. Especially in July, with 161.4 l/m², it rained twice as much as in the previous 30 years. Late Summer and Autumn were, on the other hand, very dry: From August to the end of November, the precipitation depth was measured at 199.5 mm, 92.5 less than that year's average (Fig. 7). In April 2015, the air temperature often reached 20°. After this mild phase, it was too cold until mid-May, with 12-15 °C daytime temperatures. After some very warm days (up to 28 °C) at the beginning of June, temperatures descended again (15-20 °C). Then, July began with a short very warm period, on which the temperatures could reach 15-20 °C until the end of the month. August was warm, the temperatures in September and October were ordinary. In 2016, during the whole growing season, temperatures were more or less medium. October was the only month in which temperatures were within the long-standing average (Fig. 8).

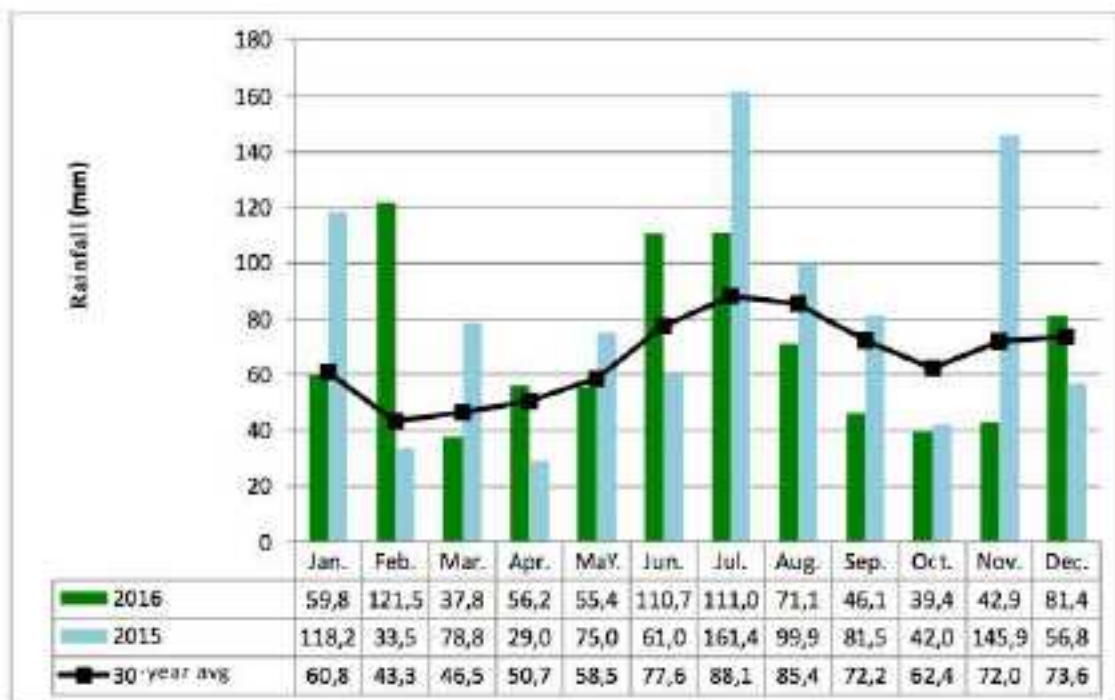


Fig. 7: Monthly total rainfall (mm) in 2015 and 2016 in Ellerhoop compared to the 30-year average (1960-1990)

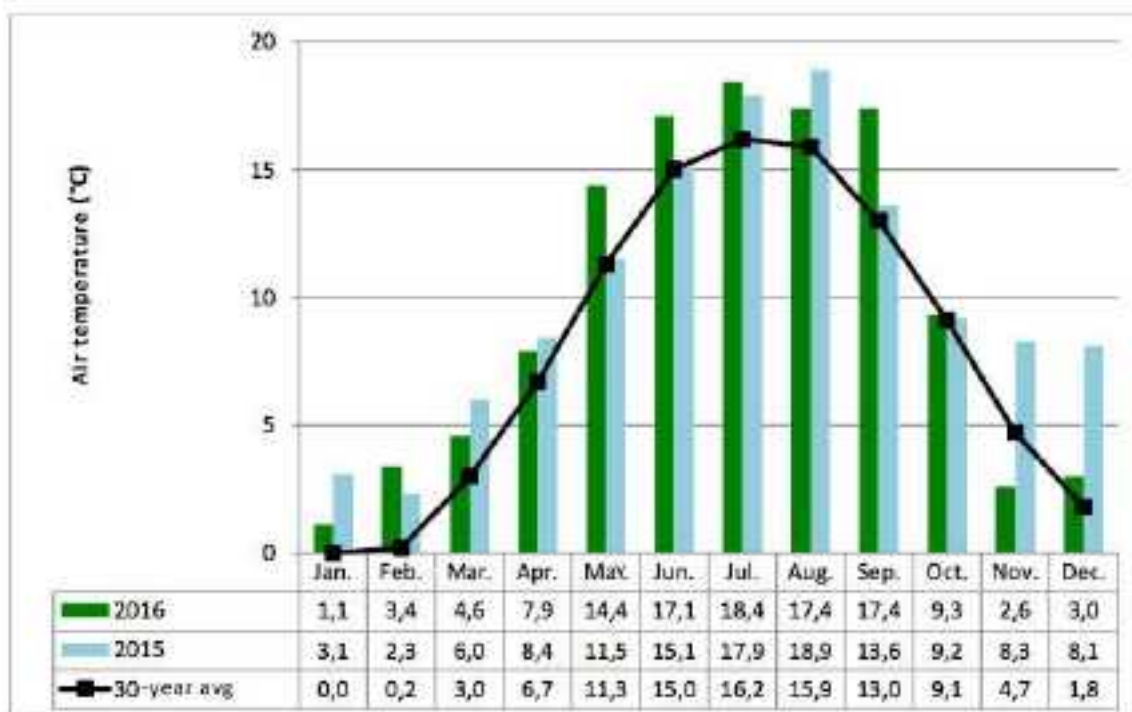


Fig. 8: Average monthly temperatures (°C) in 2015 and 2016 in Ellerhoop, measured at a height of 2 m, compared to the 30-year average (1960-1990)

3.2. Temperature profile in the pot substratum

The temperature profile in the substratum was continuously recorded from June 17, 2015 to the report date with a temperature logger. The sensors were, in each case, placed in the center of the Root Pouch and the standard container. In the aforementioned period, the average temperature amounted to 12.8 °C in the standard container and 11.6 °C in Root

Pouch (Tab. 3). The biggest difference between the two container-types can be noticed when analyzing the maximum temperature in the substratum, which is 34.8 °C in the standard container and only 26 °C in the Root Pouch. There are significant differences in minimum temperatures too, as Root Pouch's amounts to -2.6°C, while the standard container's to -5.2°C. We can therefore deduce that temperature oscillations in the Root Pouch are substantially lower than in the standard container.

Tab. 3: Minimum, maximum and average temperature (°C) of the substratum in a standard 40 l container and in a 39 l Root Pouch between 6/17/2016 and 11/18/2016, at the trial site C 15 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

Container type	Temperature of the substratum (°C)		
	Max	Avg	Min
Standard container	34.8	12.8	-5.2
Root Pouch	26.0	11.6	-2.6

Images 9-11 show the course of the daily average, highest and lowest substratum temperature during the trial. It is clearly recognisable that the temperature in the substratum of the Root Pouch never surpasses that achieved in the standard container and that the fluctuations in the Root Pouch are smaller, especially in Summer. The temperature control is thus more balanced.

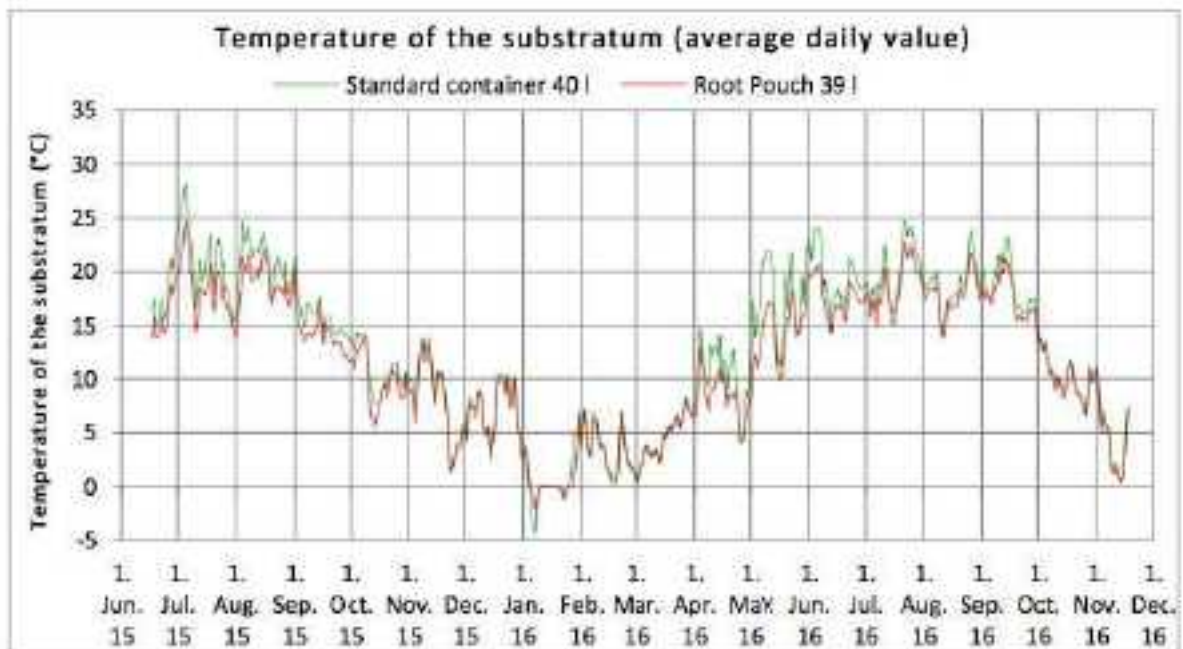


Fig. 9: Course of the average daily temperature of the substratum (°C) in a standard 40 l container and in a 39 l Root Pouch between 6/17/2016 and 10/31/2016, at the trial site C 15 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

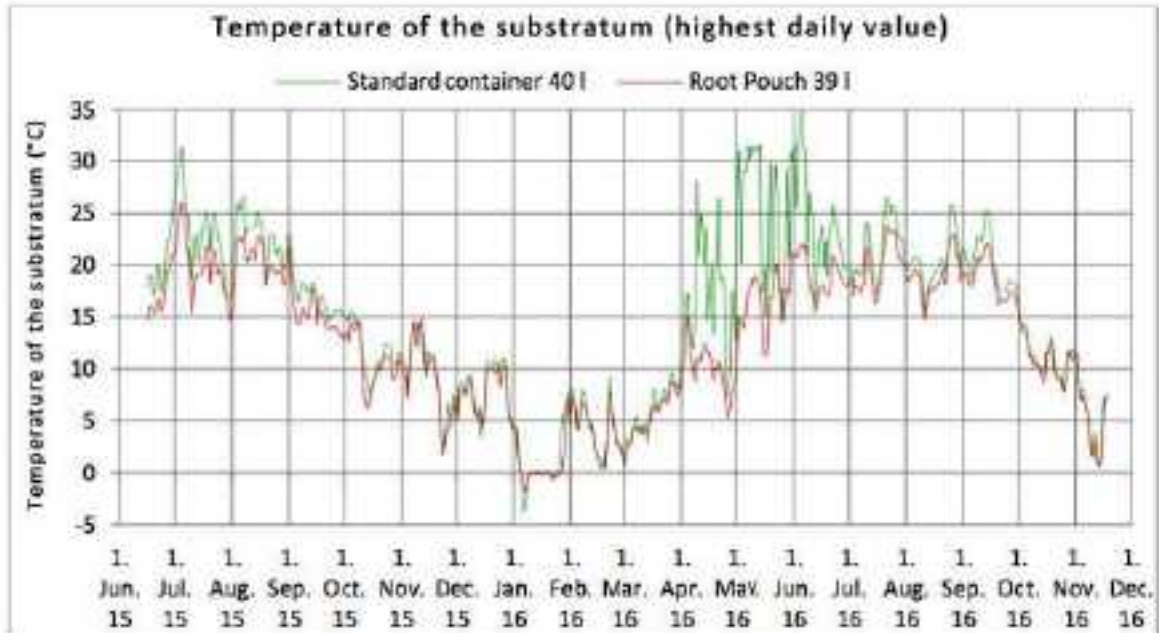


Fig. 10: Course of the highest daily temperature of the substratum (°C) in a standard 40 l container and in a 39 l Root Pouch between 6/17/2016 and 10/31/2015, at the trial site C 15 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

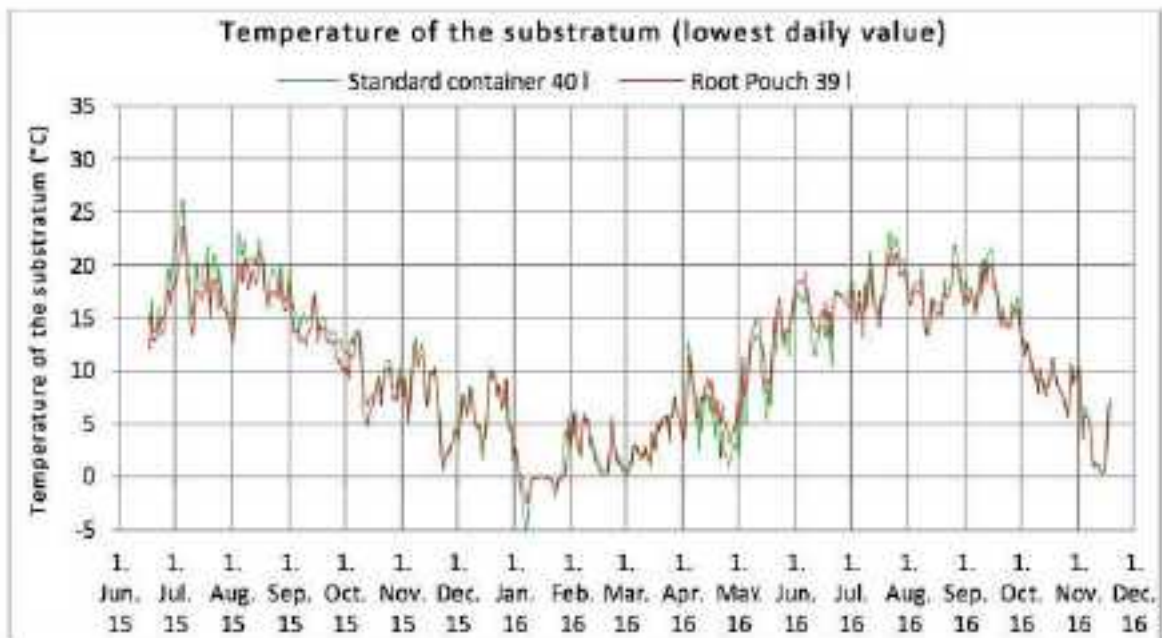


Fig. 11: Course of the lowest daily temperature of the substratum (°C) in a standard 40 l container and in a 39 l Root Pouch between 6/17/2016 and 10/31/2015, at the trial site C 15 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

4. Test results and debate

The results of the trial will be presented in the following chapters. The trials were conducted in the course of an interim evaluation of 20 plants per variant.

The results presented in the following chapters were communicated at the end of 2015 in the course of an interim evaluation of 20 plants per variant, and at the end of 2016 in the course of a final evaluation of the 20 remaining plants, with the exception of the Root Pouch variant, of which there were only 18 plants left, because 2 plants were taken to the 2016 IPM fair.

4.1. Development of the test plants during the trial period

For the 2015 growing season an optimal cultivation period could be achieved for all test-plants (Tab. 4, Fig 12). As far as growth, foliage color and damage (physiological damage, illnesses, etc.) are concerned, in all the tested pots the deviations from the optimal conditions were only minimal. The trials were conducted within the traditional environment of the Codes of Good Practice in the tree nursery. The null growth on 10/14 indicated the end of the growing season. The minimal damage at this point are leaf senescence, fungal leaf spots and minimal feeding damages due to the larvae of *Caliroa annulipes*. The damage is equally present in all the variants and did not affect the test evaluation. Also during 2016 there were no differences with regard to the vitality and the health in the three container variants.

Tab. 4: Growth, color of the foliage and damage (mark 1-9)^{a)} of *Tilia cordata* "Greenspire" avenue trees in various container systems in 2015 and 2016 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

Growth/color of the foliage/damage (1-9) in 2015							
Variant/replicates		13. May	17. Jun	14. Jul	14. Aug	09. Sep	14. Oct
Standard-container 40 l	a	991	891	991	891	891	483
	b	991	891	991	891	891	483
	c	991	891	991	891	891	483
	d	991	891	891	891	891	483
Root Pouch 39 l	a	991	891	881	991	891	483
	b	991	891	881	991	891	483
	c	991	891	881	991	891	483
	d	991	891	881	991	891	483
Air Pot 37 l	a	991	891	881	991	891	483
	b	991	891	881	991	891	483
	c	991	891	881	991	891	483
	d	991	891	881	991	891	483
Growth/color of the foliage/damage (1-9) in 2016							
		01. Jun	29. Jun	28. Jul	08. Sep	05. Oct	
Standard-container 40 l	a	991	993	693	175	165	
	b	991	993	693	175	165	
	c	991	993	693	165	165	
	d	991	993	693	165	165	
Root Pouch 39 l	a	991	993	693	175	165	
	b	991	993	693	175	165	
	c	991	993	693	175	165	
	d	991	993	693	175	165	
Air Pot 37 l	a	991	693	693	365	165	
	b	991	693	693	365	165	
	c	991	793	693	365	165	
	d	991	793	693	365	165	

a) Mark 1= very low; 3= low; 5= average; 7= high; 9= very high



Fig. 12: *Tilia cordata* “Greenspire” (6-8 cm) avenue trees in a standard container, in a Root Pouch and in an Air Pot after one and after two growing seasons (left 11/11/15, right 19/11/16)

4.2. Growth and stem diameter of the *Tilia cordata* “Greenspire”

The outcome of the trial consisted of Littleleaf linden trees in the 6-8 cm stem girth (for 1 m stem height) sorting. The stem diameter of every single plant has been measured once again after the potting (03/25/15). Four additional measuring dates (30 June, 12 Aug, 05 Oct and 11 Nov) during the 2015 cultivation period followed thereafter. During the second growing season in 2016, measurements have been taken on 14 Jun, 1 Aug, 14 Sept and 21 Oct. The data on the stem diameter shown in Tab. 5 suggest that in all three container systems the achieved results are almost the same with regard to quality and strength. The initial values were 20.0 mm (Root Pouch), 20.5 mm (standard container) and 20.9 mm (Air Pot). Both the interim and the final analysis show no significant differences between the three container systems. The average stem diameter at the end of the trial was 43.1 mm for the Root Pouch (growth during the trial period: 23 mm), 41.9 for the Air Pot (growth: 21 mm) and 42.8 for the standard container (growth: 22.3 mm). With this the stem diameter in the Root Pouch container was about 9% higher than that in the Air Pot and 3% higher than that observed in standard container.

However, it must be observed that the available fertiliser quantity for Air Pot containers (37 l) in the first year (2015) was 5% lower than that in a Root Pouch (39 l) and 8% lower than that in a standard container (40 l), because the fertiliser was mixed in the substratum before potting.

Tab. 4: Stem diameter (mm) of the *Tilia cordata* “Greenspire” avenue trees in various container systems from 2015 until 2016 at the Department of Horticulture of the Schleswig-Holstein Chamber of Agriculture, Ellerhoop

Variant	Stem diameter							
	2015				2016			
	Mar	Jun	Aug	Oct	Jun	Aug	Sep	Oct
Standard container 40L	20.5	23.1	27.6	29.9	34.7	41.4	42.5	42.8
Root Pouch 39 l	20.1	22.7	27.0	30.2	34.0	41.7	42.9	43.1
Air Pot 37 l	20.9	23.4	27.5	30.1	34.1	40.5	41.6	41.9

4.3. Stem girth and appearance grading of the *Tilia cordata* “Greenspire”

The main quality criterion when dealing with avenue trees in Germany is their stem girth. Besides, the tree must be free from other damage. Just one trial plan variant (Root Pouch) did not develop optimally, but was still merchantable. All the other test plants developed well and uniformly. Therefore, a sorting was possible after recalculating the stem diameter at the stem girth. Fig. 13 shows the gain in average stem girth during the trial. As with the results for the stem diameter, there were no significant natural differences also in terms of stem girth.

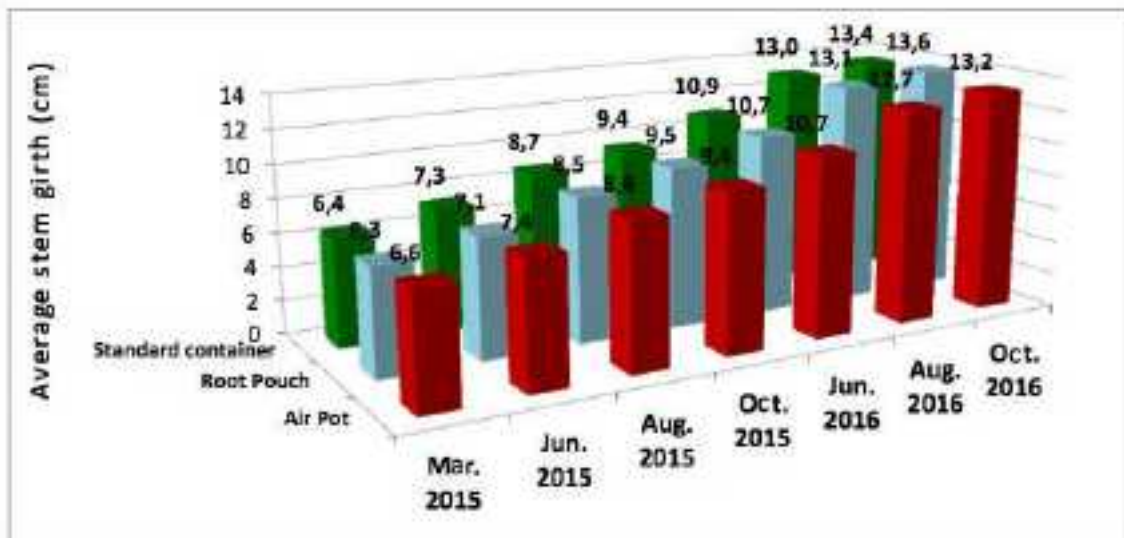


Fig. 13: Average stem girth of *Tilia cordata* “Greenspire” avenue trees in various container systems during the 2015-2016 season in Ellerhoop

Fig. 14 shows the amount of plants in the single appearance grading according to the FLL after the first test-year. At the end of the trial, 18 of the initial 20 plants in Air Pots and standard containers could be classified as 12-14 cm; two standard container plants and one

Air Pot reached the highest rank of 14-16 cm. The situation is different with Root Pouch containers. Of the just 18 initial plants, in the final evaluation, 6 ranked in the highest class. With that, the number of plants in the highest 14-16 cm class was significantly higher than in the other two container systems. However, also in this case, the different amount of fertiliser in Air Pot containers has to be taken into consideration. The fact that in Root Pouch containers two plants ranked in the 10-12 cm class should not be overvalued because, since the trial start, these two were the weakest plants among all! Summarizing, it should be pointed out that, with regard to stem diameter and girth of the test plants, there were only minor differences between the three container types, with small benefits observed in Root Pouch containers.

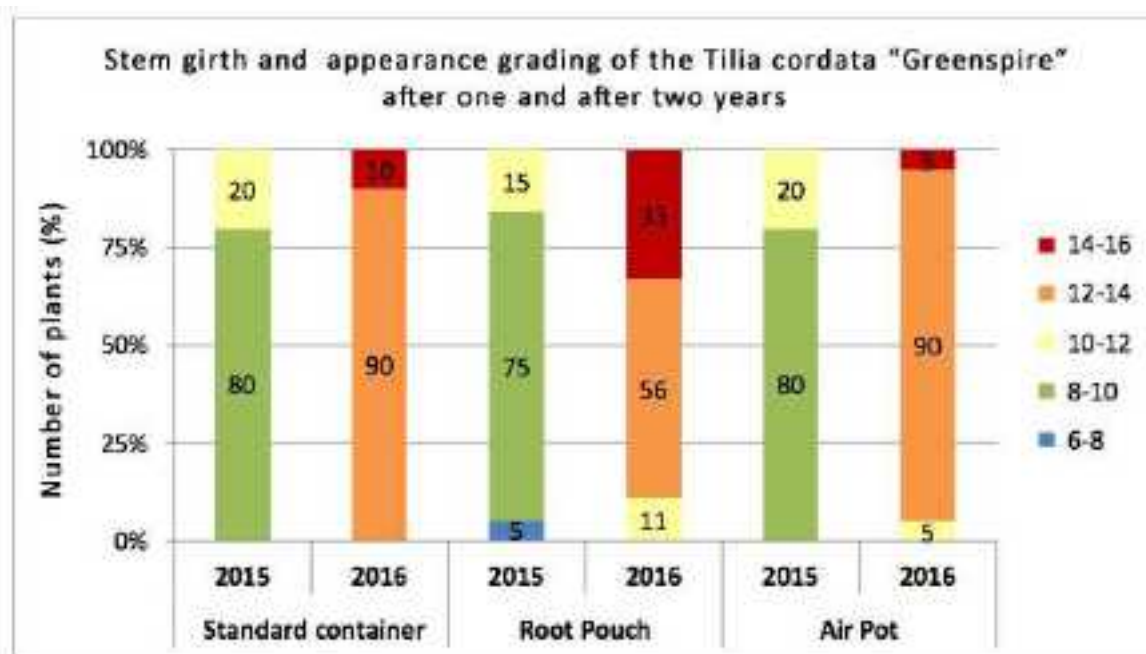


Fig. 14: Stem girth and appearance grading of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) in various container systems after one growing season (2015, Ellerhoop)

4.4. Shoot growth of the *Tilia cordata* "Greenspire"

Terminal shoot length

In order to evaluate the vitality and the vigor of an avenue tree during a growing season, the length of the terminal shoot can be pulled up.

Also here the average values between the three container types were close to each other (Fig. 15). At the end of 2015 the average terminal shoot of the trees in standard containers was the longest, measuring 131 cm, it was followed by Air Pots (8127 cm) and Root Pouch (124 cm). By contrast, at the end of 2016, the average terminal shoot length in Root Pouch containers was 114 cm, a bit longer than Air Pots and standard containers (110 cm). From a tree nursery standpoint, these small differences are to be neglected and bear no statistical relevance.



Fig. 15: Average length of the terminal shoot of *Tilia cordata* “Greenspire” avenue trees in various container systems at the end of the 2015 and 2016 growing seasons (Dispersion measure = standard deviation)

Total shoot growth

The total shoot length is the added up length of all the roots formed in the last growing season per tree. Short roots, less than 15 cm long, have not been taken into consideration. The evaluation of vitality and vigor of the respective trees is thus more precise than one made exclusively with the individual terminal shoots.

The results (Fig.16) for the three container systems differ once more only slightly. With a total length of 11.5 m (2015) and 22.2 m (2016) per tree, the average vigor of plants in Root Pouch containers was the highest ranking. The Air Pot (11.4 m 2015 and 19.9 m 2016) and the standard container (10.8 m 2015 and 20.6 m 2016) differed just marginally from the Root Pouch values and such a small difference bears no significance for the tree nursery owner.



Fig. 16: Total yearly growth of all shoots (> 15 cm) of *Tilia cordata* "Greenspire" avenue trees in various container systems in the 2015 growing season in Ellerhoop (Dispersion measure = standard deviation)

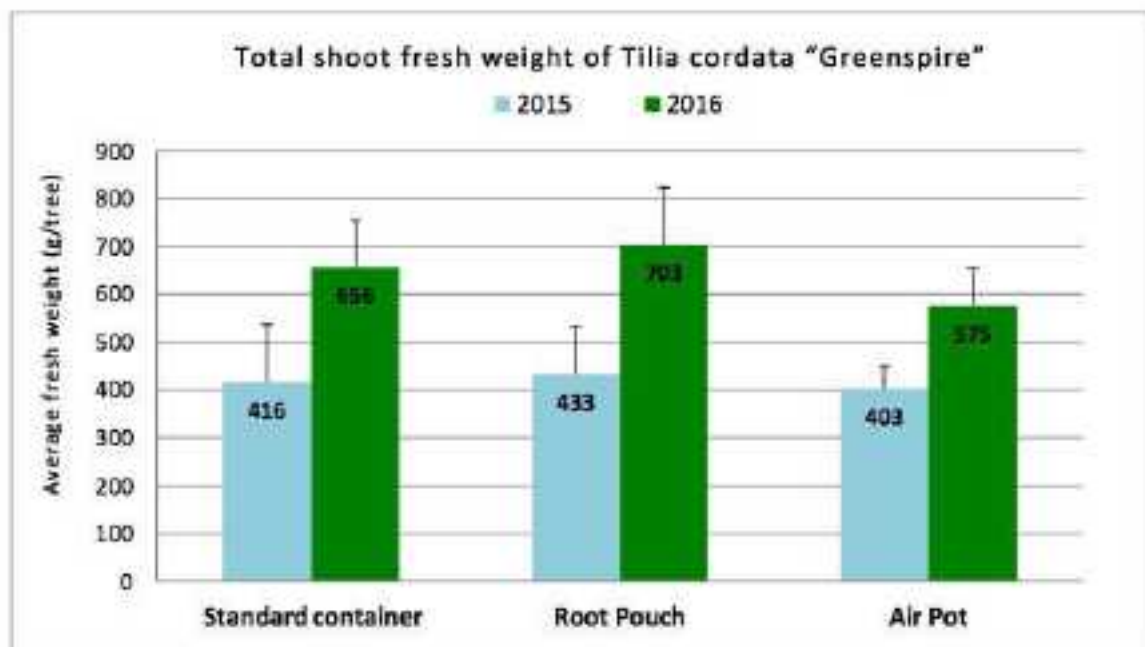


Fig 17:Total fresh weight of the yearly growth of all shoots (> 15 cm) of *Tilia cordata* "Greenspire" avenue trees in various container systems in the 2015 growing season in Ellerhoop (Dispersion measure = standard deviation)

Total shoot fresh weight

As a supplement to the total shoot length, its fresh weight is to be taken into consideration. Corresponding to the biggest average shoot growth (m) of the trees potted in Root Pouch containers, also the fresh weight (433g in 2015 and 703g in 2016) is the highest. The average weight per tree in standard containers was 416g (2015) and 656g (2016). In a

similar fashion, the Air Pot weight was 403g (2015) and 575g (2016). Here the second highest value would be expected, due to the almost identical average shoot length compared to the Root Pouch. A possible cause could be the higher number of short roots in Air Pots containers. Furthermore, just as before, it is to be taken into account as far as stem girth is concerned, that the available fertiliser quantity in standard containers in the first trial year was higher than in Root Pouch containers and particularly in Air Pot containers.

4.5. Root development of the *Tilia cordata* “Greenspire”

Number of circling roots

The previously presented results were referred to the surface sprout of the tree. As a key difference from the standard container, the Root Pouch should lead to a better development of the roots. Specifically, it is about the reduced presence of circling roots along the pot wall, compared to the standard container. Instead of developing into circling roots, in a Root Pouch container they will branch out stronger, a quality already attributed to the Air Pot container on the basis of appropriate test results and practical experience.

In the evaluation of the root patterns after the first vegetation period (two vegetation periods in the same container system are common practice), the desired effect is achieved in the Root Pouch in 2015 (Fig. 18-20). Neither the Root Pouch nor the Air Pot exhibit a ring-growing root in two 5 cm wide strips on the outer side of the pot bale, the roots reached at least 20 cm in length. In the standard container, on the other hand, in the 5 cm wide strips at the eastern and at the western side of the containers, had an average of 11.7 (root diameter >2 mm) or 10.1 (root diameter <2 mm) roots with circular growth direction and a length of more than 20 cm (Fig. 23).

At the end of the second growing season (2016) the situation was similar in Root Pouch and Air Pot containers, as depicted in Fig. 21, 22 and 24.

The two 5 cm wide strips on the east and west side of the root-ball in the standard containers showed the following situation: 80.1 roots with circular growth with a diameter of less than 2 mm and 8.2 annular roots with a diameter of more than 2 mm. Unlike at the end of 2015, when only the roots exceeding 20 cm in length were taken into consideration, this time all the roots have been counted. In Root Pouch containers and in Air Pots the number of circling roots was significantly lower, whereby the two container systems hardly differed, with a slight advantage observed in Root Pouch containers.

Strength of the circling roots

Next to the aforementioned data on the number of circling roots in two 5 cm wide sections, the numbers for the whole of the root ball regarding this root pattern have been noted (Fig. 25). The results confirm the aforementioned data on the number of circling roots. Both Root Pouch and Air Pot root patterns were evaluated with the mark 1 (=no circling roots) at the end of the 2015 growing season. On the other hand, the development of circling roots in standard containers was so strong that the grade 6.7 had to be given, which means that the circling root formation was strongly pronounced there. At the end of the second test-year (2016), the tendency of the trees to develop circling roots in the Root Pouch was rated 1.2 (= no circling roots). The Air Pot, was awarded with a slightly worse mark, 1.6, although this really only differed to a very small extent from the Root Pouch. On the other hand, the root pattern in the standard container, was evaluated with 6.5 (= strong development of the growth of the root), which was as bad as at the end of the first vegetation period (2015).



Fig. 18: Photo of the roots of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) after a growing season in a standard container (40 l). The picture was taken for an interim evaluation on 11/11/15 (Department of Horticulture - Schleswig-Holstein Chamber of Agriculture, Ellerhoop)



Fig. 19: Photo of the roots of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) after a growing season in a Root Pouch (39 l). The picture was taken for an interim evaluation on 11/11/15 (Department of Horticulture - Schleswig-Holstein Chamber of Agriculture, Ellerhoop)



Fig. 20: Photo of the roots of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) after a growing season in an Air Pot (37 l). The picture was taken for an interim evaluation on 11/11/15 (Department of Horticulture - Schleswig-Holstein Chamber of Agriculture, Ellerhoop)



Fig. 21: Photo of the roots of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) after two growing seasons in a standard container (left), in a Root Pouch (center) and in an Air Pot (left). The picture was taken for the final evaluation on 19/11/16 (Department of Horticulture - Schleswig-Holstein Chamber of Agriculture, Ellerhoop)



Fig. 22: Photo of the roots of *Tilia cordata* "Greenspire" avenue trees (6-8 cm) after two growing seasons (a and b in a standard container; c and d in a Root Pouch; e and f in an Air Pot)

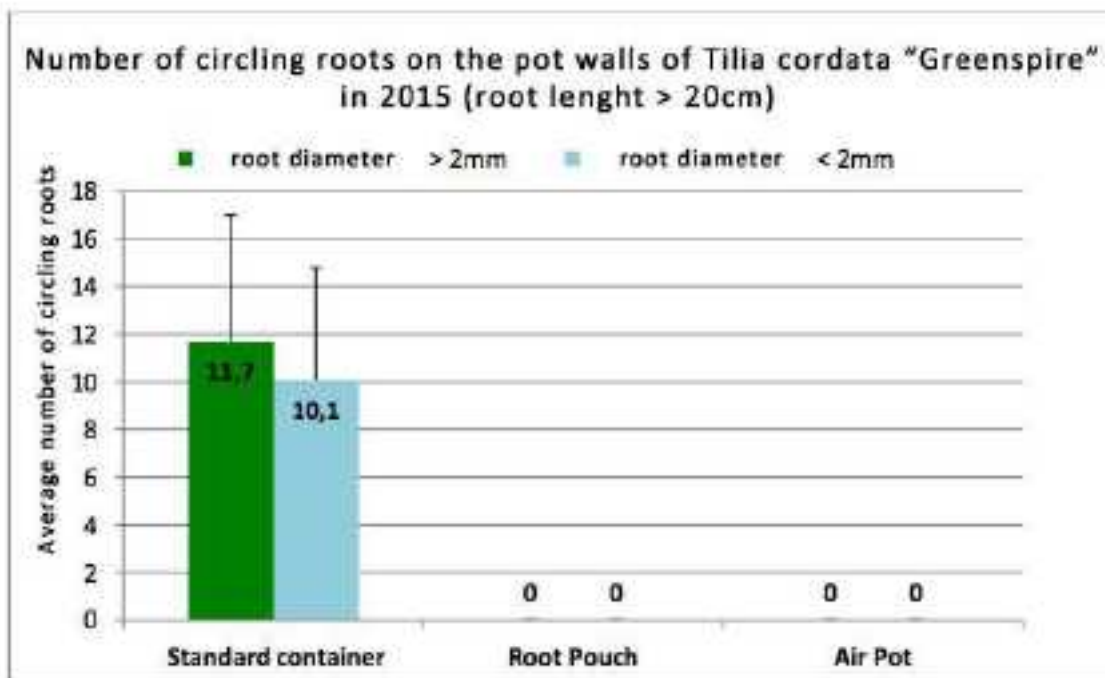


Fig. 23: Average number of circling roots on the pot walls of *Tilia cordata* "Greenspire" in relation to container systems after one growing season (Dispersion measure = standard deviation). Circling growth > 20 cm in a 5 cm wide section from the western and the eastern side of the container



Fig. 24: Average number of circling roots on the pot walls of *Tilia cordata* "Greenspire" in relation to container systems after two growing seasons (Dispersion measure = standard deviation). Circling growth > 20 cm in a 5 cm wide section from the western and the eastern side of the container

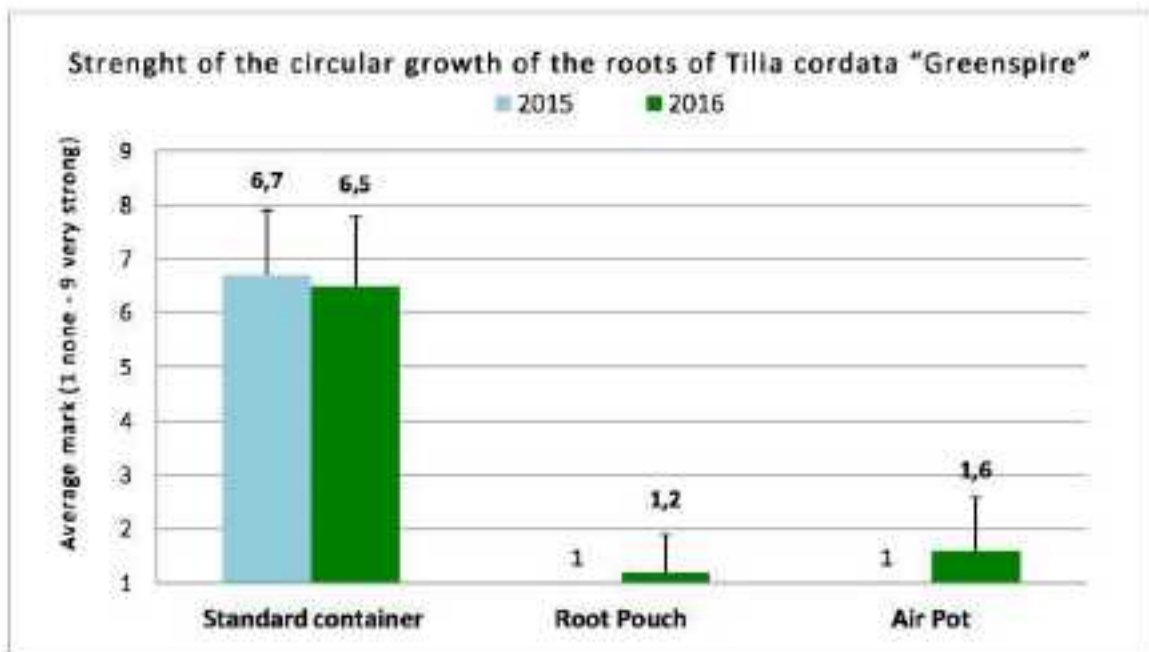


Fig. 18: Markedness of circling shoots of the roots of *Tilia cordata* "Greenspire" avenue trees in various container types during the first growing season (Ellerhoop, 2015+2016)

5. Summary

In the years 2015 and 2016, on behalf of Drehandel GmbH (10245 Berlin, Germany) and Root Pouch (Hillsboro, Oregon 97124, USA), the suitability of the 39 l Root Pouch container system was tested by the Schleswig-Holstein Chamber of Agriculture, Department of Horticulture (25373 Ellerhoop, D) in an alley tree nursery. The container systems 'standard container' (40 l plant bucket) as well as the Superroots Air Pot (37 l) were used as a direct comparison. The Littleleaf linden *Tilia cordata* 'Greenspire' (high-stem, stem circumference 6-8 cm, from a container culture) were cultivated. The report summarizes the results of an intermediate evaluation after the first vegetation period and the final evaluation after the second vegetation period, as the usual cultivation period in the container is 2 years until the next repotting / transplanting. The culture took place in a turf-based tree substrate with industry standard fertilization and adapted droplet irrigation on a conventional container culture site.

The trees were tied to bamboo poles in the course of the cultivation and at the same time fixed to a structure to protect them against the windthrow. All plants developed well and uniformly in the first as well as in the second year of culture. The interim evaluation took place on 11/11/2015, whereby every second tree from all the varieties was taken from the experiment and examined with regard to the growth of the shoot, the commercial sorting and, in particular, the root pattern. The remaining trees were further cultivated for a growing season and were evaluated with regard to the same parameters in the final evaluation on 11/19/2016. There were no significant differences in the development of the underground plant parts in 2015 or 2016. This means that the measured values for the following parameters, which were used to assess shoot growth, differed only insignificantly:

- Increase in stem diameter
- Commercial sorting
- Length of the terminal shoot
- Total length of the shoot (as well as its fresh weight)

On the other hand, the difference in the root patterns was very clear. In the standard container, a relatively large number of circling roots was found along the pot walls. This was not observed in Root Pouch and Air Pot containers.

Compared to the standard container, the temperature profile in the substrate in the root pouch was much more balanced, with a particular emphasis on maximum temperatures, that in the root pouch were significantly lower than in the standard container.