Paulownia trees are indigenous to China and have been used as an agroforestry tree for over 2600 years due to their many positive attributes and multifunctional uses. The genus was named in honor of Queen Anna Paulowna from The Netherlands (1795-1865), the daughter of Tsar Paul I of Russia. Paulownia (P. tomentosa) is also known as the Chinese Empress tree. (Zhou-Hua et al. 1986) states that there are several species in the Paulownia genus which are native to Asia. Paulownia, in particular P. tomentosa, has been planted as an ornamental tree in NW Europe since the early 1800’s but has not been considered as a possible commercial species in the region until the last few years. The results of studies, based on data gathered from existing sites, presented by Jensen J. B. (2016), indicates that Paulownia species and the hybrids could grow successfully as a commercial agroforestry crop in north-western Europe. Paulownia can be propagated by seeds, roots or stem cuttings. There are many commercial hybrids, available for sale from plant nurseries, depending on the climate and commonly available in Europe. Weshinu (2001) noted that some excellent Paulownia hybrids have been bred recently, for example Paulownia Fortunei x P. tomentosa that provide up to 30% higher timber volume than Paulownia elongata while still being suitable for intercropping. Paulownia trees are characterized by a wide range of uses. Whether the goals of a Paulownia planting are site recreation, animal waste utilization, rapid biomass production, or predicated for paper production (Olsan J. and Carpenter S. 1985), Paulownia is an appropriate tree for intensive management in hardwood plantations with short rotation because of its rapid growth, ability to stunt sprout and the wide variety uses for its wood and fiber. Paulownia does not require replanting after harvest, because it regenerates from stump sprouts. Paulownia wood is used for a multitude of products because it is attractive, strong, lightweight, quick-drying, and has good resistance qualities. The wood is easily worked and will not split or crack when spines are driven into it or with rapid drying (Clutterbuck W.K., Hodges D.G. 2004). Due to the high price of balsa, Paulownia wood is also used as an element of composite construction material, which can replace balsa wood in sandwich structures applied among ships, aircrafts, automobiles or wind energy systems. Li W, Weijing L., Hai F, Ding Z. 2011. It has been recorded that an 8-10 year old Paulownia tree can produce 100 kg of fresh leaves per year (Wang Q and Shogren J.F. 1992). The leaves and flowers of Paulownia are rich in nitrogen and other nutrients which could serve as good natural fertilizer (Wang Q and Shogren J.F. 1992). Furthermore, the leaves of Paulownia have a high nutritive content suitable for ruminants (Bodnariu et al., 2014) and can be ensiled as a fodder crop. The leaves are also fed to pigs and rabbits (Wang Q and Shogren J.F. 1992; Zhou-Hua et al., 1986).

MATERIALS AND METHODS

The field researches were conducted during 2016 vegetable season at the forest nursery “Bielie Blitze” (Bydgoszcz Forest Division). Experiment was run on a brown podsolic soil formed from a loose sandy soil. Two years old seedlings (from rootstock) were planted in two rows with spacing of 5 meters in row and 3 meters between rows. The experiment was designed as one-factorial trial. One factor was considered: sprinkler irrigation (control – without irrigation, sprinkler irrigation). Sprinkler irrigation was started 14 days after tree seedlings planting (1 May) and ended on 30 September during the first 14 days after planting, seedlings did not from leaves. Irrigation was used to supplement natural rainfall. The irrigation was done using solid-set hand-line irrigation system with overhead impact sprinklers mounted on risers. The irrigation radius of sprinklers was R = 10 m. The water output was 2.5 m3/h. Water for irrigation was taken from the retention reservoir located in the forest nursery. The term of irrigation was dependent on current precipitation and its main objective was the plant growth. Sprinkler irrigation was realized in accordance with the recommendations for forest nurseries on open areas. The total irrigation dose applied from 1 May to 30 September was 170 mm. The increase of the height of Paulownia seedlings, the trunk diameter (measured at the height of 5 cm) and the number and surface of leaves for two variants of experiment were determined at 30 day intervals.

RESULTS

Sprinkler irrigation significantly affected the height of Shan Tong Paulownia (Fig. 1). The difference in plant height was observed throughout all months of vegetation season. The biggest difference between the variants of experiment was observed in September. It was equal to 58.3 centimeters (78.5% more than control variant). During the vegetation season, irrigated Paulownia gave an averages of 68.2% more growth than non-irrigated trees. The fastest monthly growth increase of irrigated Paulownia (57.7 cm) was observed between June and July. For non-irrigated (control) variant, dynamic growth was observed also between June and July. Monthly growth during this period was equal to 34 cm. Analyzing the results of the study of the trunk diameter, leaf number and surface, it can be stated that irrigation watering had significant influence on the tested parameters. The monthly average increase of trunk diameter for the control variant was equal to 5.2 mm, while for the irrigated Paulownia 7.9 mm (52% more). At the end of the vegetation season the irrigated plants achieved an average of 39.7 mm of the trunk diameter (Fig. 2) while the non-irrigated ones only 25.9 mm.

The difference in trunk diameter growth was 53.3%. The leaf’s area of the of irrigated Paulownia, measured in June, was larger than the one of non-irrigated tree, and the difference between them was equal to 233.7 cm² (266.5% more). The similar difference in size of leaf area for both variants of the experiment was observed in September. The difference in measured leaf size of irrigated and non-irrigated Paulownia was 143.6 cm² (243.4%). Comparing the results of leaf area measurements, made in August and September, it can be stated that already in August the maximum leaf area was obtained for both variants of the experiment.

CONCLUSIONS

- Paulownia trees, cultivated in Poland, may become to be the valuable source of timber and biomass.
- By analysing the results of the study on trunk diameter leaf number and surface, it may be stated that irrigation watering significantly influenced the tested parameters. Irrigation significantly increased the height of Paulownia seedlings. The average difference between the variants (irrigated and control) at the end of the growing season was 65.5% on average. The difference in trunk diameter growth was 53.3%.
- The sprinkler irrigation applied in the experiment resulted in an increase in the number of leaves of both variants of the forest nursery, which resulted in an increase in biomass yield. The difference in measured leaf size of irrigated and non-irrigated Paulownia was 1346.3 cm² (243.4%).
- It is necessary to repeat the experiment to accurately determine the technology of irrigation.

REFERENCES