

RINGKASAN

Wortel (*Daucus carota* L.) merupakan tanaman sayuran umbi-umbian yang memiliki banyak manfaat bagi kesehatan tubuh dan tumbuh optimal di daerah bersuhu dingin dengan ketinggian 900–1.500 m dpl. Keterbatasan lahan di dataran tinggi akibat alih fungsi lahan menyebabkan penurunan produksi, sementara budidaya di dataran rendah menghadapi tantangan suhu tinggi yang menghambat pertumbuhan dan hasil. Pencemaran tanah akibat penggunaan pestisida berlebihan dan serangan penyakit tular tanah seperti *Rhizoctonia*, *Pythium*, dan *Fusarium* menjadi kendala dalam budidaya wortel secara konvensional. Penggunaan sistem aeroponik menjadi alternatif budidaya yang efisien di lahan terbatas dengan memanfaatkan kabut nutrisi ke akar tanaman. Salah satu teknologi pendukung adalah *root zone cooling*, yakni pengendalian suhu larutan nutrisi pada zona perakaran agar tetap optimal. Penelitian ini bertujuan untuk mengetahui suhu larutan nutrisi yang sesuai, serta memberikan informasi pertumbuhan dan hasil tanaman wortel akibat pengendalian suhu larutan nutrisi pada sistem aeroponik di dataran rendah dengan harapan dapat memberikan informasi ilmiah dan teknologi tepat guna bagi pengembangan pertanian hidroponik di Indonesia.

Penelitian dilaksanakan di *Experimental Farm*, Fakultas Pertanian, Universitas Jenderal Soedirman dengan ketinggian ± 110 m dpl. Sistem hidroponik yang digunakan adalah aeroponik. Metode penelitian yang digunakan yaitu Rancangan Acak Lengkap (RAL) dengan 2 faktor dan 4 ulangan. Faktor pertama yaitu suhu larutan nutrisi (T) terdiri dari 16°C dan 28°C. Faktor kedua yaitu varietas (V) terdiri dari New Kuroda, Gemuk, dan Berastagi. Variabel iklim mikro meliputi suhu udara, kelembapan udara, dan intensitas cahaya yang disajikan dengan grafik. Variabel pertumbuhan tanaman meliputi tinggi tanaman (cm), panjang umbi (cm), jumlah umbi, diameter umbi (cm), jumlah cabang daun (helai) dan bobot umbi segar (g), dianalisis menggunakan ANOVA dan uji lanjut DMRT 5%.

Hasil penelitian menunjukkan bahwa suhu udara maksimal di dalam *greenhouse* pada siang hari pukul 13.00 WIB mencapai 34,11°C dan suhu udara terendah pada pagi hari pukul 07.00 WIB sebesar 25,97°C. *Relative Humidity* terendah terjadi pada pukul 13.00 WIB sebesar 55% dan *Relative Humidity* tertinggi mencapai 86% pada pukul 07.00 WIB. Intensitas cahaya paling tinggi terjadi pada pukul 13.00 WIB mencapai (3811,54 *lux*) dan paling rendah pada pukul 17.00 WIB sebesar (1447,84 *lux*). Pemberian suhu larutan nutrisi yang berbeda memberikan pengaruh terhadap tinggi tanaman, jumlah cabang daun, panjang umbi, jumlah umbi, diameter umbi dan bobot umbi segar. Suhu larutan sebesar 16°C memberikan hasil terbaik dibandingkan suhu larutan sebesar 28°C. Kombinasi suhu 16°C dengan varietas New Kuroda menghasilkan hasil tertinggi, yaitu tinggi tanaman 37,5 cm, jumlah cabang daun sebanyak 154, panjang umbi 30 cm, diameter umbi 5,1 cm, dan bobot umbi segar 59,2 gram. Suhu larutan nutrisi 16°C menjadi suhu yang optimal untuk budidaya tanaman wortel sistem aeroponik di dataran rendah dan wortel varietas New Kuroda menghasilkan pertumbuhan terbaik dari budidaya menggunakan sistem aeroponik di dataran rendah.

SUMMARY

Carrot (Daucus carota L.) is a tuberous vegetable crop that offers numerous health benefits and grows optimally in cool climates at altitudes of 900–1,500 meters above sea level. Limited land availability in highland areas due to land-use conversion has led to reduced production, while cultivation in lowland areas faces challenges such as high temperatures that hinder growth and yield. Soil pollution from excessive pesticide use and soil-borne diseases like Rhizoctonia, Pythium, and Fusarium also pose problems in conventional carrot farming. Aeroponic systems serve as an efficient alternative cultivation method on limited land by delivering nutrient mist directly to plant roots. One supporting technology is root zone cooling, which involves controlling the temperature of the nutrient solution around the root zone to remain optimal. This study aims to determine the appropriate nutrient solution temperature and provide information on the growth and yield of carrot plants under nutrient solution temperature control using an aeroponic system in lowland areas, with the goal of contributing scientific insight and practical technology for the development of hydroponic agriculture in Indonesia.

The research was conducted at the Experimental Farm, Faculty of Agriculture, Jenderal Soedirman University, at an altitude of approximately 110 meters above sea level. The hydroponic system used was aeroponics. The research design was a Completely Randomized Design (CRD) with 2 factors and 4 replications. The first factor was nutrient solution temperature (T) consisting of 16°C and 28°C. The second factor was carrot variety (V), including New Kuroda, Gemuk, and Berastagi. Microclimate variables included air temperature, humidity, and light intensity, presented in graphical form. Plant growth variables included plant height (cm), root length (cm), number of roots, root diameter (cm), number of leaf branches (leaves), and fresh root weight (g), which were analyzed using ANOVA and followed by DMRT at a 5% significance level.

The results showed that the maximum air temperature inside the greenhouse during the day at 1:00 PM reached 34.11°C, while the lowest air temperature at 7:00 AM was 25.97°C. The lowest relative humidity occurred at 1:00 PM at 55%, and the highest at 7:00 AM at 86%. The highest light intensity occurred at 1:00 PM (3811.54 lux), and the lowest at 5:00 PM (1447.84 lux). Different nutrient solution temperatures significantly affected plant height, number of leaf branches, root length, number of roots, root diameter, and fresh root weight. A solution temperature of 16°C produced the best results compared to 28°C. The combination of 16°C temperature and New Kuroda variety produced the highest yield, including a plant height of 37.5 cm, 154 leaf branches, 30 cm root length, 5.1 cm root diameter, and 59.2 grams fresh root weight. Thus, a nutrient solution temperature of 16°C is optimal for aeroponic carrot cultivation in lowland areas, and the New Kuroda variety shows the best growth performance under these conditions.