

宁夏日光温室与塑料大棚环境对比分析

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摘要:以宁夏日光温室和塑料大棚环境为研究对象,对比分析了2种设施条件下室内空气温湿度和15 cm土壤温度,以促进当地设施农业发展。结果表明:从室内气温上看,日光温室气温高于塑料大棚;晴天二者日均气温相差2.3℃,但差异不显著;阴天二者相差2.2℃,差异显著。从季节变化来看,也是日光温室气温高于塑料大棚的温度;从室内土壤温度上看,日光温室土壤温度高于塑料大棚土壤温度;晴天二者日均土温相差1.2℃,差异显著;阴天二者相差2.6℃,差异显著。从室内湿度上看,晴天日光温室平均湿度大于塑料大棚空气湿度,二者平均值分别为73.4%、70.2%;阴天也是日光温室空气湿度大于塑料大棚空气湿度,均值分别为81.4%、76.0%,但差异均不显著。从季节变化来看,整个试验期日光温室空气湿度平均为68.2%,塑料大棚为72.1%,二者结论相反,这与温室管理无法统一有关。

关键词:日光温室;塑料大棚;温度;湿度;比较

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日光温室和塑料大棚是设施农业中最主要、最常见、最普及的结构形式。它们具有良好的增温效果及保温性能,为创造作物生长发育所需的小气候环境提供了

可行性,更为反季节生产及获得优质高产农产品提供了技术保障^[1-5]。因此研究比较二者的微环境对促进设施农业发展具有重要意义。

关于日光温室和塑料大棚环境因子方面,国内学者已经从光、温、湿等方面做了大量研究^[6-12],为提高日光温室和塑料大棚保温性奠定了良好的基础,而这些研究都是相对独立的,有关二者环境因子比较研究的较少。但在实际生产中,园区中既有日光温室也有塑料大棚,

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The Effect of Ventilation on the Venlo Greenhouse Air Temperature in Summer in Jiangnan Plain

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Abstract: With the Venlo greenhouse in Jiangnan plain as research object, the effect of nature ventilation and mechanical ventilation on the Venlo greenhouse air temperature in summer was investigated. The results showed that the temperature inside greenhouse was always within 33℃ during the early summer while only natural ventilation was used. However, it was higher than 35℃ in the middle of summer. For mechanical ventilation, the temperature inside greenhouse was nearly within 35℃ during the early summer and midsummer. The period of high temperature was short. But in the height of summer, it was higher than 35℃ for a long time. From the above, it could be concluded that mechanical ventilation could meet the cooling demand for greenhouse in Jianhan plain.

Key words: greenhouse; natural ventilation; mechanical ventilation; cooling effect

种植同一种作物,在管理上既有差别又有共同点,充分利用2种温室各自的环境特征,提高温室管理水平是一项重要的工作。该试验通过对宁夏银川地区日光温室和塑料大棚环境的测定,分析了二者的环境差异,对提高日光温室和塑料大棚管理水平具有重要意义。

1 材料与方法

1.1 试验温室

试验地位于宁夏永宁县(38°20'N,16°15'E)杨和镇现代农业科技示范园区。

塑料大棚为钢架结构,南北两面墙体,长度95 m,跨度16 m,脊高4.2 m,南北延长,棚内2008年定植“红地球”葡萄。日光温室为坐北朝南,东西延长,长度88 m,跨度9 m,后墙高2.8 m,脊高3.5 m,东西山墙及北墙为平均2.5 m厚土捣墙,棚内2008年定植“红地球”葡萄。覆盖材料均采用PVC长寿无滴膜,棚膜外均覆盖保温被。12月初左右升温。

1.2 试验方法

塑料大棚温度测定位于中部偏东,即由北向南48 m,距东边6.5 m的交叉处。日光温室中测定同样位于温室中部,由东向西约40 m处,距后墙6 m。测定棚内外1.5 m高处空气温度、湿度,棚内光照强度、土层15 cm处地温。测试期间同时记录天气阴晴状况。于2011年12月4日至2012年6月15日,用哈尔滨物格电子技术有限公司生产的PDE-R4 4路PT100温度记录仪和PDK1温湿度光照度记录仪,每1 h采集1次。

1.3 数据分析

试验数据采用DPS软件进行统计分析,白天与夜间区分以揭闭帘为界。

2 结果与分析

2.1 2种设施内空气温湿度及地温比较

2.1.1 2种设施内气温日变化比较 由图1可知,无论晴、阴天,均为日光温室气温高于塑料大棚。晴天日光温室日均气温为17.8℃,塑料大棚为15.5℃,二者平均相差2.3℃。阴天日光温室日均气温为16.2℃,塑料大棚为14.0℃,二者平均相差2.2℃。说明日光温室保温性要高于塑料大棚。

2.1.2 2种设施地温日变化比较 由图2可知,不论晴、阴天日光温室土壤温度总是高于塑料大棚。晴天日光温室日均土温为16.2℃,塑料大棚日均土温为15.0℃,二者平均相差1.2℃。阴天日光温室日均土温为16.2℃,塑料大棚日均土温为13.6℃,二者平均相差2.6℃。说明日光温室保温性优于塑料大棚,在阴天显得尤为明显。

2.1.3 2种设施室内空气湿度日变化比较 由图3可知,不论日光温室、塑料大棚室内空气湿度总体均大于

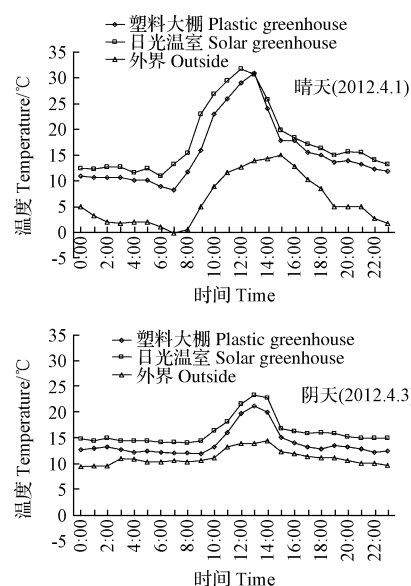


图1 温室内、外气温日变化

Fig. 1 The temperature changes in and outside greenhouse during the day

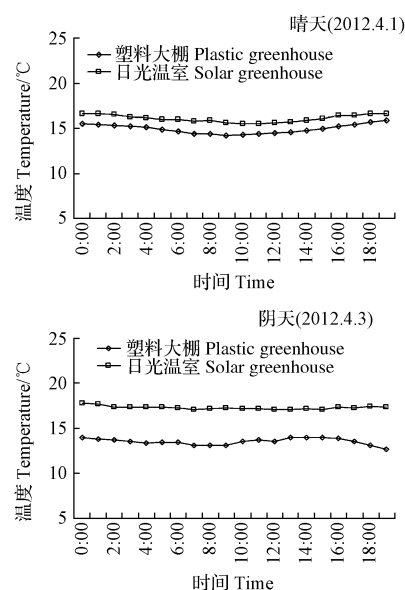


图2 温室内15 cm土壤温度日变化

Fig. 2 Soil temperature at depth of 15 cm in the greenhouses during the day

外界空气湿度。晴天日光温室平均湿度大于塑料大棚空气湿度,二者平均值分别为73.4%、70.2%。阴天也是日光温室空气湿度大于塑料棚空气湿度,均值分别为81.4%、76.0%。

2.1.4 各指标方差分析 利用DPS数据统计软件对图1、2、3数据进行方差分析。由表1可知,日光温室内气温均值高于塑料大棚,晴天二者差异不显著,阴天差异显著。同样,空气湿度也是晴天不显著,阴天显著。二

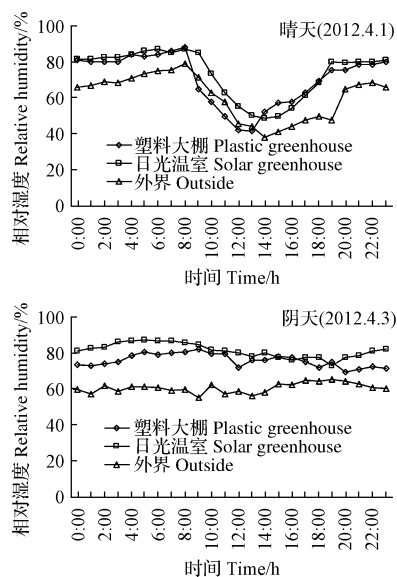


图3 温室内空气湿度日变化

Fig. 3 The relative humidity changes in the greenhouse during the day

表1 温室环境因子统计分析结果

Table 1 The results of statistical analysis with the greenhouse environment factors

天气 Weather	设施 Facility	室内气温 Temperature in greenhouse	室内空气湿度 Air humidity in greenhouse	15 cm 土温 15 cm soil temperature
晴天 Sunny day	日光温室 Solar greenhouse	17.8±1.33aA	73.4±2.72aA	16.16±0.09aA
	塑料大棚 Plastic greenhouse	15.5±1.32aA	70.2±2.9 aA	15.04±0.12bB
阴天 Cloudy day	日光温室 Solar greenhouse	16.2±0.54 aA	81.4±0.84 aA	16.24±0.06aA
	塑料大棚 Plastic greenhouse	14.0±0.54bB	76.0±0.744bB	13.60±0.07bB

注:小写字母表示 $P<0.05$,大写字母表示 $P<0.01$,结果表示为: $M\pm SD$;每种天气条件下,2种温室环境因子比较。

者土温在晴阴天情况下差异均显著。

2.2 室内环境因子旬变化比较

由图4可知,1~4月份,日光温室气温明显高于塑料大棚气温,这段时间内日光温室平均气温为14.3℃,塑料大棚气温为10.2℃。4月以后,由于外界气温升高,二者管理不统一,温度差异缩小;在土温方面,日光温室土壤温度总是高于塑料大棚土壤温度,整个试验期间,日光温室土温平均为15.4℃,塑料大棚为13.0℃。在湿度方面,日光温室空气湿度平均为68.2%,塑料大棚为72.1%。

3 结论

从室内气温来看,日光温室气温高于塑料大棚。晴天日光温室日均气温为17.8℃,塑料大棚为15.5℃,二

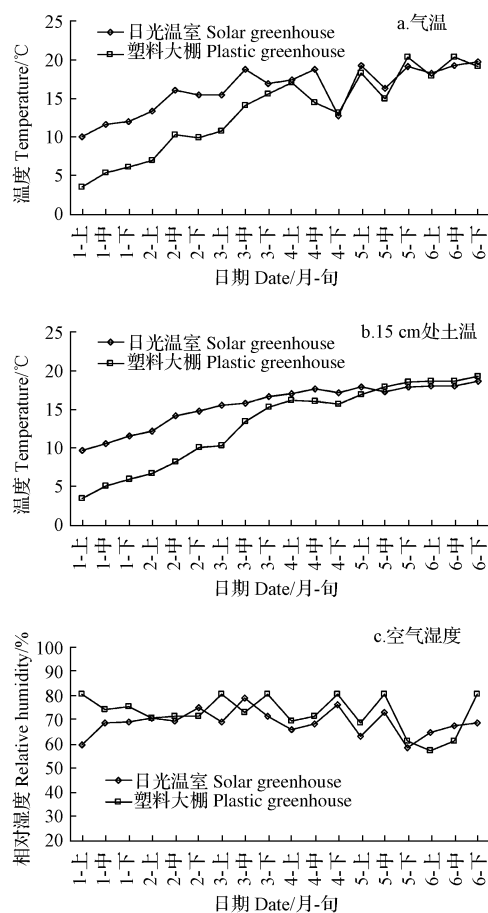


图4 2种设施环境因子旬变化

Fig. 4 The changes of environment factors in the two greenhouses every ten days

者平均相差2.3℃,差异不显著。阴天日光温室日均气温为16.2℃,塑料大棚为14.0℃,二者平均相差2.2℃,差异显著。从季节变化来看,也是日光温室气温高于塑料大棚的温度,1~4月二者均温分别为14.3℃和10.2℃。

从室内土壤温度来看,日光温室土壤温度高于塑料大棚土壤温度。晴天日光温室日均土温为16.2℃,塑料大棚日均土温为15.0℃,二者平均相差1.2℃,差异显著。阴天日光温室日均土温为16.2℃,塑料大棚日均土温为13.6℃,二者平均相差2.6℃,差异显著。1~6月日光温室和塑料大棚土壤温度分别为15.4、13.0℃。

从室内湿度来看,晴天日光温室平均湿度大于塑料大棚空气湿度,二者平均值分别为73.4%、70.2%。阴天也是日光温室空气湿度大于塑料棚空气湿度,均值分别为81.4%、76.0%。但差异均不显著。从季节变化来看,整个试验期日光温室空气湿度平均为68.2%,塑料大棚为72.1%。二者结论相反,这与温室管理无法统一有关。

由于2种设施田间管理不统一,致使空气湿度变化幅度较大,很难确定二者湿度的高低;另外,2种设施条件下葡萄与气象环境之间的影响有待进一步探索。

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Comparative Analysis on Environment in a Solar Greenhouse and Plastic Greenhouse in Ningxia

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Abstract: Taking solar greenhouse and plastic greenhouse in Ningxia as research object, air temperature and humidity, soil temperature at depth of 15 cm in two greenhouses were comparatively analyzed, in order to promote the development of facility agriculture. The results showed that, in terms of indoor air temperature, the temperature in a solar greenhouse was higher than the plastic greenhouse. On sunny days, the average temperature in a solar greenhouse during a day was 2.3°C higher than in the plastic greenhouse, but the difference was not so obvious on sunny days. On cloudy days, the average temperature in a solar greenhouse during a day was 2.2°C higher than in the plastic greenhouse, the difference was so obvious on cloudy days. The condition was the same according to the changes of the seasons. In terms of indoor soil temperature, the soil temperature in a solar greenhouse was higher than the plastic greenhouse. On sunny days, the average soil temperature in a solar greenhouse during a day was 1.2°C higher than in the plastic greenhouse, the difference was so obvious on sunny days. On cloudy days, the average soil temperature in a solar greenhouse during a day was 2.6°C higher than in the plastic greenhouse, the difference was so obvious too. In terms of indoor humidity, on sunny days, the average humidity in a solar greenhouse was higher than in the plastic greenhouse, the average values were 73.4% and 70.2% respectively. On cloudy days, the average humidity in a solar greenhouse was higher than in the plastic greenhouse too, the average values are 81.4% and 76.0% respectively, but the difference was not so obvious on cloudy days. According to the changes of the seasons, the average humidity in a solar greenhouse and in the plastic greenhouse were 68.2% and 72.1% in the whole experimental period, evidence showed the reverse that dues to different management. This research was of great significance to explore the different types of facilities agriculture development.

Key words: solar greenhouse; plastic greenhouse; temperature; humidity; compare