UNIVERSITI PUTRA MALAYSIA

THE EFFECTS OF DAY/NIGHT FORCING TEMPERATURE REGIMES, GROWTH RETARDANTS AND ETHEPHON TREATMENTS ON TULIPS (TULIPA GESNERIANA VAR 'CASSINI')

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By

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Chairman : Associate Professor Thohirah Lee Abdullah, PhD

Faculty : Agriculture

Three studies were conducted to determine the forcing procedures for potted tulip and postharvest treatments for cut tulips under tropical conditions.

The objectives of the first study were to examine the protein profiles alteration associated with various day/night forcing temperatures (26/22, 26/18, 26/14, 22/18, 22/14 and 18/14 °C) and to identify a potential protein marker that is involved in producing a good quality tulip through the SDS-PAGE method. The experimental design used was an incomplete block design with three replications per treatment. There were no significant differences in plant height, perianth length, flower diameter, no. of days to first visible bud and no. of days to senescence for plants treated under different day/night temperature regimes. Only scape length, no. of days to coloured bud stage and anthesis stage were significantly affected. Protein profiles obtained from one dimensional gel electrophoresis from plants forced under different day/night temperatures showed no differences in protein banding patterns. Protein no. 2 at vegetative stage and protein no. 37 and 38 at anthesis stage were found to

have potential as protein markers that could be involved in producing good quality tulip which was revealed in 2D gel electrophoresis.

Second study was carried out in order to determine the optimal concentration of paclobutrazol and flurprimidol on height control of potted tulips. Two experiments were carried out by using two different growth redartants at different rates. In experiment I paclobutrazol at 0, 5, 10, 15, 20 and 25 $mg.L^{-1}$ were used while in experiment II flurprimidol was used at 0, 20, 40, 60, 80 and 100 $mg.L^{-1}$. The experimental design used was a completely randomised design with five replications per treatment. In experiment I, plant height and scape length, perianth length and flower diameter were significantly affected by paclobutrazol treatment. There were no significant differences in no. of days to first visible bud, no. of days to coloured bud stage, no. of days to anthesis and no. of days to senescence. The optimal rate of paclobutrazol for height control of 'Cassini' tulip was 20 $mg.L^{-1}$ with reduction of 13.6% in plant height and 14.8% in scape length. In experiment II, plant height, scape length, perianth and flower longevity were significantly affected by flurprimidol treatment. There were no significant differences in no. of days to first visible bud, no. of days to coloured bud stage, no. of days to anthesis and flower diameter. The optimal rate of flurprimidol in controlling plant height of 'Cassini' tulip was 40 mg/L with reduction of 13.8% and 17.4% for plant height and scape length respectively.

Third study was carried out to determine the effect of ethephon pretreatment on stem elongation and flower longevity of cut tulips. Treatments comprised basal stem dip in ethephon at 0, 20, 40 and 60 $mg.L^{-1}$ for 0, 15 and 30 minutes. The experimental

design used was a completely randomised design with five replications per treatment. Ethephon pretreatment significantly reduced the last internode length, scape length and flower opening rate. The reduction of stem length was due to the reduction in cell length which was revealed by histological study. Ethephon at 20 to 40 $mg.L^{-1}$ and duration of dipping time from 15 to 30 minutes were found to effective in overcoming the problem of stem elongation without reducing flower quality.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains Pertanian

KESAN RAWATAN KOMBINASI SUHU SIANG/MALAM, BAHAN PERENCAT TUMBESARAN DAN ETHEPHON TERHADAP TULIP (*Tulipa gesneriana var* 'Cassini')

Oleh

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June 2004

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Tiga kajian telah dijalankan untuk menentukan cara penanaman bunga tulip berpasu dan rawatan lepastuai untuk keratan bunga tulip di kawasan tropika.

Objektif kajian pertama adalah untuk mengkaji perubahan profil protein berkaitan dengan pelbagai suhu penanaman siang/malam (26/22, 26/18, 26/14, 22/18, 22/14 dan 18/14 ^{o}C) dan juga untuk mengenalpasti penanda protein yang berpotensi dalam penghasilan bunga tulip yang berkualiti melalui kaedah SDS-PAGE. Rekabentuk eksperimen yang digunakan adalah rekabentuk blok tidak lengkap dengan tiga replikasi untuk setiap rawatan. Tiada perbezaan yang bererti pada tinggi pokok, panjang perianth, diameter bunga dan bilangan hari untuk pengeluaran kudup pertama dan bilangan hari untuk senesen untuk pokok yang dirawat di bawah suhu siang/malam yang berbeza. Hanya panjang scape, bilangan hari untuk pewarnaan kudup dan antesis menunjukkan perbezaan yang bererti. Profil protein yang diperolehi dari gel elektroforesis satu dimensi untuk pokok yang ditanam pada suhu siang/malam yang berbeza tidak menunjukkan perbezaan yang bererti pada corak jalur protein. Protein no. 2 pada peringkat vegetatif dan protein no. 37 dan 38 pada

peringkat antesis didapati adalah penanda protein yang berpotensi untuk menghasilkan bunga tulip yang berkualiti yang ditunjukkan oleh gel elektroforesis dua dimensi.

Kajian kedua dijalankan untuk menentukan kadar paclobutrazol dan flurprimidol yang optimal untuk mengawal tinggi pokok berpasu. Dua eksperimen telah dijalankan dengan menggunakan dua jenis bahan perencat pertumbuhan yang berbeza pada kadar yang berlainan. Eksperimen pertama menggunakan paclobutrazol pada kadar 0, 5, 10, 15, 20 dan 25 $mg.L^{-1}$ manakala eksperimen kedua menggunakan flurprimidol pada kadar 0, 20, 40, 60, 80 dan 100 $mg.L^{-1}$. Rekabentuk experimen yang digunakan ialah rekabentuk penuh rawak dengan lima replikasi bagi setiap rawatan. Dalam eksperimen pertama, tinggi pokok, panjang scape, panjang perianth dan diameter bunga telah menunjukkan perbezaan yang bererti dengan rawatan paclobutrazol. Tiada perbezaan yang bererti untuk bilangan hari untuk pengeluaran kudup pertama, bilangan hari untuk antesis and bilangan hari untuk senesen. Kadar optima paclobutrazol untuk pengawalan tinggi pokok tulip 'Cassini' ialah 20 $mg.L^{-1}$ dengan pengurangan sebanyak 13.6% pada tinggi pokok dan 14.8% panjang scape. Untuk eksperimen kedua, tinggi pokok, panjang scape, panjang perianth dan jangka hayat bunga menunjukkan perbezaan yang bererti dengan rawatan flurprimidol. Tiada perbezaan yang bererti untuk bilangan hari untuk pengeluaran kudup pertama, bilangan hari untuk pewarnaan kudup, bilangan hari untuk antesis dan diameter bunga. Kadar optima flurprimidol untuk pengawalan tinggi pokok tulip 'Cassini' ialah 40 $mg.L^{-1}$ dengan pengurangan sebanyak 13.8% and 17.4% bagi tinggi pokok dan panjang scape masing-masing.

Kajian ketiga dijalankan untuk menentukan kesan pra-rawatan ethephon pada pemanjangan batang dan jangka hayat bunga keratan tulip. Rawatan terdiri daripada rendaman pangkal keratan ke dalam ethephon pada kadar 0, 20, 40 and 60 $mg.L^{-1}$ selama 0, 15 dan 30 minit. Rekabentuk eksperimen yang digunakan ialah rekabentuk penuh rawak dengan lima replikasi untuk setiap rawatan. Pra-rawatan ethephon yang digunakan didapati berkesan dalam pengurangan panjang internod terakhir, panjang scape dan kadar pembukaan bunga. Kepekatan ethephon pada kadar 20 hingga 40 $mg.L^{-1}$ dan jangka masa rendaman dari 15 hingga 30 minit didapati berkesan untuk mengatasi masalah pemanjangan tangkai bunga tanpa menjejaskan kualiti bunga tulip.

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31A Longitudinal sections of the last internode of the stem of the 'Cassini' tulip prior to ethephon treatment (40X magnification). More compacted and small cells were observed prior to ethephon treatment just after harvesting 121

31B&31C Figure 31B and 31C indicated internode treated with 0 $mg.L^{-1}$ of ethephon and 0 minute and 20 $mg.L^{-1}$ of ethephon and 0 minute of dipping time respectively. Due to the absence of the ethephon effect, all cell showed increased in cell length if compared to ethephon treated internodes 122

31D&31E Figure 31D and 31E indicated internode treated with 40 $mg.L^{-1}$ of ethephon and 0 minute of dipping time and 60 $mg.L^{-1}$ of ethephon and 0 minute of dipping time respectively. All cells showed increased in cell length without the ethephon treatment 123

31F&31G Figure 31F indicated internode treated with 0 $mg.L^{-1}$ of ethephon and 15 minutes of dipping time. Longer cell length was observed in all types of cells as observed in Figure 31B, 31C, 31D and 31E. Figure 31G indicated internode treated with 20 $mg.L^{-1}$ of ethephon and 15 minutes of dipping time. Due to the ethephon treatment effect, shorter cell length was observed if compared to non-treated internodes 124

31H&31I Figure 31H indicated internode treated with 40 $mg.L^{-1}$ of ethephon and 15 minutes of dipping time. Shorter cell length was observed if compared to figure 31G due to increased in ethephon concentration. Figure 31I indicated internode treated with 60 $mg.L^{-1}$ of ethephon and 15 minutes of dipping time. Shorter cell length was observed if compared to figure 31H with increased of ethephon concentration from 40 $mg.L^{-1}$ to 60 $mg.L^{-1}$ 125

31J&31K Figure 31J indicated internode treated with 0 $mg.L^{-1}$ of ethephon and 30 minutes of dipping time. Longer cell length was observed due to the absence of ethephon treatment. Figure 31K indicated internode treated with 20 $mg.L^{-1}$ and 30 minutes of dipping time. Shorter cell length was observed as compared to figure 31G, this was due to longer dipping time in the ethephon with the same concentration 126

31L&M Figure 31L indicated internode treated with 40 $mg.L^{-1}$ of ethephon and 30 minutes of dipping time. Shorter cell length was again observed if compared to non-treated internodes. Figure 31M indicated internode treated with 60 $mg.L^{-1}$ of ethephon and 30 minutes of dipping time. This is the highest ethephon concentration and longest dipping time. More compacted and shorter cells were observed if compared to the rest of the treatment 127