Studies on photomorphogenesis in some economical plants

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SUMMARY AND CONCLUSIONThis study was carried out at the Experimental Farm Station of the Faculty of Agriculture, Moshtohor, Zagazig University, Benha Branch during the two growing successive seasons of 2001 and 2002 on two commercial crops, tomato (Lycopersicon esculentum, Mill. cv. super strain B) and sweet pepper (Capsicum annuum L. cv. Baldy).The aim of this experiment was to study the effect of some new promising treatments, black, red, red + black and blue polyethylene mulch surface colors on some morphological, anatomical and physiological characteristics as well as flowering, yield and fruit quality of both tomato and sweet pepper plants compared to bare soil treatment (unmulched).Five-week-old tomato and sweet pepper seedlings (i.e., at 20th and 15th of February for 2001 and 2002 seasons, respectively) were transplanted to the experiment plots.The obtained results could be summarized as follow: I- Light reflection:a)The applied of red and red + black mulch colors were reflected more red and far-red light during the two growing seasons 2001 and 2002 comparing with black and blue mulch colors. Also, FR/R ratio was improvement and the most effective in this respect.b)These values were obtained from reflection of the red light 43.52 & 49.85 & 11.98 and 14.18% and from reflection of the far-red light 50.12 & 54.52 & 13.70 and 9.78% with red,SUMMARY & CONCLUSION263red + black, blue and black mulch colors, respectively, at mid-day of April during 2001 season. Also, these values from reflection of the red light 46.58 & 51.43 & 15.32 and 13.04% and from reflection of the far-red light 49.87 & 55.90 & 18.35 and 10.55% with red, red + black, blue and black mulch colors, respectively, at mid-day of May during 2001 season.c) This reflection of red and far-red light from red mulch color were absorbed by plants and act through phytochrome pigment system to improvement the vegetative and increased reproductive growth of tomato and sweet pepper plants. II- Vegetative growth: 1- Tomato plants:a)The used of mulch colors (black, red, red + black and blue) were significantly increased the all vegetative characteristics i.e., plant height, stem diameter, shoots fresh weight g/plant, number of branches and leaves and leaf area/plant. Also, different mulch colors were significantly increased dry weight of branches and leaves.b)The used of red mulch color was increased the number of branches per plant this increase more than two times and also leaf area per plant increased more than three times of the control plants with red and red + black mulch colors, respectively, at 45 and 60 days after transplanting during 2001 and 2002 seasons.c)Moreover, the red and red + black mulch colors gave the highest concentration of chlorophyll a & b and carotenoids ofSUMMARY & CONCLUSION 264tomato plant at both 45 and 60 days after transplanting during 2001 and 2002 seasons. 2- Sweet pepper plants:a)All vegetative characteristics expressed as plant height, stem diameter, shoots fresh weight g/plant, number of branches and leaves, leaf area/plant and dry weights of branches and leaves were increased to reach the high level of significance with different mulch color applied of sweet pepper plant at 45 and 60 days after transplanting during 2001 and 2002 seasons.b)Number of branches per plant was increased to reach the high level of significance with red and red + black treatments. This increase more than 5 and 7 times of the control plants, respectively, at 45 and 60 days after transplanting during 2001 and 2002 seasons. Also, leaf area/plant increased more than three times of the control with red and red + black in 2001 and 2002.c)Also, different applied mulch colors increased photosynthetic pigments i.e., chlorophyll a & b and carotenoids as well during the two assigned

seasons. Moreover the red + black treatment ranked the first followed by red one. III- Chemical composition: 1- Tomato plants:a) Different mulch colors increased minerals concentration (N, P, K, Ca and Mg mg/g d.w) and crude protein in tomato leaves at 45 and 60 days after transplanting during the two assigned seasons. Also, various used mulch color increasedSUMMARY & CONCLUSION265iron and manganese but decrease zinc concentrations in tomato leaves at 60 days after transplanting during 2002 season.b)Moreover, reducing, non-reducing and total sugars (mg/g f.w) also total carbohydrates (mg/g d.w) were increased with different used mulch color at the two time of determination, i.e., at 45 & 60 days after transplanting during 2001 and 2002 seasons.c)High concentration of total carbohydrates in tomato leaves were obtained with red and red + black mulch colors compared with control plants during 2001 and 2002 seasons.d)These values were 397.67, 368.60 & 608.60, 579.57% and 339.72, 483.84 & 579.89, 544.29% for the total carbohydrates in tomato leaves with red and red + black colors at 45 and 60 days after transplanting, respectively, in 2001 and 2002 seasons. 2- Sweet pepper plants:a)All mulch colors increased (N, P, K, Ca and Mg mg/g d.w) and crude protein concentration in leaves of sweet pepper plant at 45 and 60 days after transplanting during two seasons. Also, different applied mulch colors increased iron and manganese meanwhile decreased zinc concentration in leaves of sweet pepper plants at 60 days after transplanting during 2002 season.b)Furthermore, reducing, non-reducing and total sugars (mg/g f.w) and also total carbohydrates (mg/g d.w) were increased with different applied mulch colors at 45 and 60 days afterSUMMARY & CONCLUSION 266transplanting in 2001 and 2002 seasons. Red and red + black gave the highest values in this respect.C) Red and red + black treatments obtained the highest concentration of total carbohydrates in sweet pepper leaves compared with control plants during the two assigned seasons.d) These values were 375.00, 350.00 & 816.67, 761.11% and 512.68, 713.38 & 490.68, 723.73% for the total carbohydrates in sweet pepper leaves with red and red + black colors at 45 and 60 days after transplanting, respectively, during 2001 and 2002 seasons. IV- Reproductive growth: 1- Tomato plants:a)Plants grown above different used mulch colors opend their flowers earlier than control plants. The most effective, color in this respect was the red one ranked the first. These days of earliness with red mulch color reached to 47.71 and 47.90% more than control values during 2001 and 2002 seasons, respectively. Also, red and red + black mulch colors gave the highest values for each of number of flowers, total fruits per plant and percentages of fruit setting as well.b)All mulch colors increased early and total yields in term of number of early and total fruits per plant, weight of early and total fruits per plant as well as early yield (%) and relative total yield (%) at the two seasons compared with those of the control treatment.SUMMARY & CONCLUSION267c)The highest early and total fruit yields were obtained with red and red + black mulch colors.d)These values were 1984.70, 2460.78 & 2483.72, 2386.34 g/plant and 4.83, 5.32 & 5.34, 5.14 kg/plant for the early and the total yields per plant with red and red + black in 2001 and 2002 seasons, respectively.e)The used of different mulch color treatments improvement the physical characteristics of tomato fruits and increased the average of fruit size, fresh and dry weight, length, diameter and shape index per plant compared with the control.f)The quality characteristics of tomato fruits i.e., vitamin C, titratable acidity and total soluble solids as well as minerals concentration (N, P, K, Ca and Mg mg/g d.w) and also, reducing non-reducing, total sugars and total carbohydrates were increased with all applied mulch colors. Also, red and red + black treatments ranked the first in this respect. 2- Sweet pepper plants:a)Red and red + black mulch colors gave the highest value in earliness of flower anthesis. Furthermore different mulch colors were significantly increased number of flowers total fruits per plant and percentage of fruit setting during the two assigned seasons.b)High significant increase in the number of early and total sweet pepper fruit per plant, weight of early and total fruits per plant as well as early yield (%) and relative total yield (%) were existed with different applied mulch colors during 2001 and 2002 seasons compared with bare soil treatment.SUMMARY & CONCLUSION 268c)Red and red + black treatments gave the highest values of early and total fruit yields.d)These values were 991.45, 1112.52 & 1220.84, 1175.23 g/plant and 2.20, 2.49 & 2.64, 2.85 kg/plant for the early and the total yields per plant with red and red + black in 2001 and 2002 seasons, respectively.e)The physical characteristics of sweet pepper fruits were improved by using different mulch colors and increased the average of fruit size, fresh and dry weight, length, diameter and

shape index per plant compared with the control.f)All mulch color treatments increased the quality characteristics of sweet pepper fruits i.e., the amount of vitamin C, total soluble solids and titratable acidity as well as minerals concentration (N, P, K, Ca and Mg mg/g d.w) also, total sugars and total carbohydrates. The highest sweet pepper fruits quality were obtained with red and red + black mulch colors. V- Endogenous phytohormones: 1- Tomato plants:a)Different used color mulches decreased the level of endogenous gibberellins (GA3) in tomato shoots at 60 days after transplanting during 2002 season meanwhile that obvious increased in this level existed with red + black treatment. Also,. auxins (IAA), its level in tomato shoots behaved as the same as gibberellins.b)Furthermore, cytokinins were increased with red, red + black and blue colors and red + black one was the moreSUMMARY & CONCLUSION269pronounced in this respect at 60 days after transplanting during 2002 season. 2- Sweet pepper plants:a)Endogenous gibberellins, it is obvious that black, red and red + black mulches increased its level by 413.78, 279.91 and 476.12%in sweet pepper shoots more than the control,respectively, at 60 days after transplanting during 2002 season.b)Different applied of color mulches decreased the level of endogenous auxins in sweet pepper shoots at 60 days after transplanting during 2002 season. Meanwhile, cytokinins was dominantly increased with various color mulches and reached its maximum (1629.4% more than the control) with the red +black treatment in sweet pepper shoots at 60 days after transplanting in 2002 season. VI- Anatomical study: 1- Tomato plants:a)All mulch colors were increased thickness of mesophyll tissue in tomato leaves at 60 days after transplanting during 2002 season. Increased more than control were 70.05, 51.34,42.78 and 40.64 with red + black, red, black and blue mulches, respectively.b)Also, various applied mulch colors were increased midrib thickness, vascular region length and width, phloem tissue thickness and xylem tissue thickness, number of vessels andwidest vessel diameter. The red and red + black treatments gave the highest values in this respect.& CONCLUSION270c) These values were 151.34, 170.05 & 137.57, 147.35 & 152.81, 136.25 & 157.63, 141.53 and 128.46, 150.00% for the thickness of mesophyll tissue, length and width of vascular region, phloem tissue thickness and xylem tissue thickness in tomato leaves with red and red + black colors, respectively, compared with control plants at 60 days after transplanting during 2002 season. 2- Sweet pepper plants:a)Blue, red and red + black treatment were increased the thickness of mesophyll tissue but only decreased with black treatment in sweet pepper leaves at 60 days after transplanting.b)Also, red + black mulch colors gave the highest values on vascular region length and width phloem tissue thickness and vessels number of xylem tissue in sweet pepper leaves at 60 days after transplanting during 2002 season.c)These values were 127.38, 108.65 & 142.81, 142.14 & 127.54, 169.06 & 133.93, 127.68 and 148.13, 150.80% for the thickness of mesophyll tissue, length and width of vascular region, phloem tissue thickness and xylem tissue thickness in sweet pepper leaves with red and red + black colors, respectively, compared with control plants at 60 days after transplanting during 2002 season.Finally, it could be noticed that the red mulch color might considered as the greatest economic treatments regarding not only earliness of the fruit yield but also its quality as well.SUMMARY & CONCLUSION271CONCLUSIONThe FR-reflecting, red mulch made to our specifications enhanced early crop yields of tomato and sweet pepper compared with yields over standard black plastic mulch. Effectiveness of the red mulch is attributed primarily to the FR/R photon ratio reflected to the developing fruit and nearby leaves from the mulch surface. This allows field plants to receive incoming sunlight for photosynthesis, and morphogenic light reflected from the mulch surface to regulate allocation of photosynthate. Action of the FR/R ratio is through the phytochrome system within the growing plants and it regulates photosynthate allocation to the developing parts, including fruit. The red mulch surface area must remain intact and be large enough to reflect morphogenic light to the developing parts of the plant, especially the fruit and nearby leaves.SUMMARY & CONCLUSION 272