RESPONSE OF CUCUMBER FOR MULCH COLORS AND PHOSPHORUS LEVELS UNDER GREENHOUSE

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Abstract

Trails were carried out during the two growing seasons of 2007 and 2008 at El-Bosaily farm, Agricultural Research Center, El-Behira Governorate, Egypt. This research was conducted in an unheated greenhouse to determine the effect of different mulch colors and phosphorus fertigation on growth and yield of cucumber plant. Cucumber seedlings (*Cucumis sativus* L cv. Brenjee 82) were grown in sandy soil. The plastic house constructor was covered with 200 µm local-UV-treated polyethylene sheet (PE) of 5.25 m in width. Five mulch colors were used, i. e., red, green, blue, black and transparent. Control treatment was unmulched. Three phosphorus fertigation levels 20, 40 and 60 ppm were added to soil under different colors mulch and control. Soil temperature at surface and at 15 cm depth of each mulch colors were measured. The vegetative growth, i. e., plant height, number of leaves, fresh and dry weight of plant, early and total yield were recorded. The results showed that transparent mulch gave the highest soil temperature followed by black mulch in comparison with other mulch colors. The best vegetative growth (plant height, number of leaves, total leaf area, canopy fresh and dry weight) and yield (early and total) were obtained by transparent followed by black mulch. The transparent mulch color increased N, P and K % leaves content followed by black color with significant difference between them. The phosphorus use efficiency (PUE) was greatest at the lowest dose 20 ppm of P and decreased as the P levels were increased. On the other hand, the vegetate growth and yield were in vice case with PUE. The interaction between mulch color and P gave the highest vegetative growth and yield under transparent mulch combined with 60ppm P.

Key words: mulch color, cucumber, soil temperature, phosphorus fertilizer

INTRODUCTION

Different types of mulch affect the vegetative growth and yield of cucumber plants, whereas different mulch colours and types affects soil temperatures and lead to favorite effect on the growth and yield of cucumber plants. The influence of the type of polyethylene mulch on soil temperature and crop response was dependent upon film color (Lippert and Witing, 1964). Black polyethylene exchanged large quantities of energy with the atmosphere and caused relatively small changes in soil temperature while transparent polyethylene film transmitted radiation to the soil

surface, which was absorbed and converted to sensible heat (Salman, and Gorski, 1985). Plastic mulching increased total yield and shoot concentration of N, P, K, Ca, Mg, Cu and B inspire of the fact that mulching plants were larger than un-mulched plants. An increase in the soil temperature may interfere with the nutrient levels in plants. As the temperature rises, calcium and phosphorus tend to diminish and nitrogen and potassium tend to increase, as well as the growth or the aerial part of the plant (Teasdale and Abdul- Baki, 1995). Mulching with black PE film, producing higher yields, reduces the leaching of nitrate fertilizers, which reduce a potential risk of surface and ground water pollution by nitrate (Romic *et al.,* 2003). The color of mulch determines its energy-radiating behavior and its influence on the microclimate around the plant. Black, transparent, and white mulches predominate in the commercial vegetable production today over the world. Soil temperature can strongly influence root initiation, root growth and nutrient uptake, and subsequently impact shoot development and mineral nutrient accumulation of plants (Tagliavini *et al.* 1991).

Soil temperature influences water and nutrient uptake, metabolic processes and roots and shoot growth (Toselli *et al.* 1999). In many plant species, nutrient uptake by roots decreases at low root zone temperatures (Vasilieva *et al.* 1999). The goal of this study was to determine the effects of mulch color and phosphorus level on cucumber yield grown under greenhouses

MATERIALS AND METHODS

This experiment was carried out in El-Bosaily farm, El-Behira Governorate, in the North Coast of Egypt. It was carried out in single greenhouses, 60 m long and 9 m wide with 3 m height. The plant was grown in bed with 1m width and 60m length in the two sides. The distance between rews was 50 cm, This experiment confined two factors. The first factor included six treatments which were five mulch colors (red, green, blue, black and transparent) and control without mulch. Low density polyethylene sheets of 100 mm thick were used as mulch. The second factor comprised three phosphorus fertigation levels (20, 40 and 60 ppm). Phosphoric acid 85% purity was the source of P during the two seasons. The total phosphorus amount during the season depend on fertigation system which were 4, 8 and 12 g / plant for the 20, 40 and 60 ppm, respectively. The experiment was designed in a split-plot design with three replications. Phosphorus fertigation were in the main plots, mulch colors were allocated in the sub plots. The greenhouse was divided into five ridges separated by pathway of 60cm wide. Each ridge was 100-cm width and 60 meters long. Seedlings of cucumber (*Cucumis sativus* L cv. Brenjee 82) were grown in

a 70% peat-moss: 30% vermiculite (v/v) substrate mix in polyethylene containers. Soil temperature was measured by digital soil thermometer at 15 cm depth in February, March and April. Dates of seeding were Jan -12-2007 and Jan -15-2008, for the first and the second seasons, respectively. The transplanting took place on, -5-2007 and Feb -7-2008, for the 1st and the 2nd seasons, respectively. A sample of 5 plants of each experimental plot was taken to determine plant height, number of leaves, total leaf area, fresh and dry weight after 70 days from transplanting. Total yield was calculated as summation of all harvests for each treatment and divided into number of plants to calculate the average of plant yield. The average of the first fourth harvests was calculated as the early yield. Leaf contents of N, P, K were determined. The different plant organs were oven dried at 70 °C and the dry matter was recorded, then the leaves were fine grounded for the chemical analyses. The grounded leaves were digested in H_2SO_4 and phosphorus and potassium were determined in acid digested solution by colorimetric method (ammonium molybdate) using spectrophotometer and flame photometer (Chapman and Pratt, 1961). Total nitrogen was determined by Kjeldahl method according to the procedure described by FAO (1980).

Phosphorus use efficiency (PUE) was calculated as the yield obtained from the P (Yp) fertilized plot minus control (Yc), divided by a unit weight of the applied fertilizer (Pw for phosphorus) by (Kogbe and Adediran, 2003).

PUE = (Yp-Yc)/Pw

Analysis of variance (ANOVA) was performed on vegetative growth and yield variables (SAS, 1999) and appropriate error terms for the F tests of interactions were calculated separately. Comparisons of means were performed using the Duncan's multiple range test (= 0.05).

RESULTS AND DISCUSSION

Soil Temperature

The values of soil temperatures with mulching were mulch higher than without mulching. This may be owing to mulching prevents cooling of the soil surface due to evaporation. Average soil temperature at 15 cm depth under different mulch color from February to April is shown in Figures (1 and 2). During the crop cycle, mulching with both transparent and black polyethylene significantly and consistently raised soil temperatures over the entire study period.

Generally, soil temperature under mulches was higher than control by 4-5°C. The obtained results are in agreement with those of Fonsecal *et al.,* (2003). Sunlight passes through the clear plastic and heats the soil. A layer of water on the underside of the plastic retains the radiant heat at night through what is known as a greenhouse

effect. Black plastic mulch absorbs most of the sunlight and becomes greatly warmed, and little energy passes through to warm the soil (Maged, 2006).

Vegetative growth

The effect of different mulch color and phosphorus level on vegetative growth characters (plant height, number of leaves, total leaf area, canopy fresh and dry weights) was presented in Tables (1 and 2). Regarding the effect of different mulchs color treatments, data showed that using transparent mulch increased plant height, number of leaves and dry weight followed by black mulch with significant difference between them. On the other hand, there was no significant difference between green and blue mulch color. The lowest vegetative growth was obtained under control treatment during the two studied seasons. The use of phosphorus levels on vegetative growth showed that the level 60 ppm was gave the highest vegetative growth followed by 40 ppm with significant difference between them. Regarding the interaction effect between different mulch color and phosphorus levels, data illustrated that the highest vegetative growth characters obtained by using transparent mulch combined with 60 ppm phosphorus followed by black mulch with 60 ppm phosphorus level. On the other hand, the lowest vegetative growth characters were obtained from using control (without mulch) treatment with 20 ppm phosphorus during the two seasons. The obtained results are in agreement with those of Soltani *el al.*, (1995), who revealed that mulching has contributed positively to higher soil production, temperature and consequently improving growth and yield. Plastic mulch increase soil temperature and gave rise to aeration that helping the nitrification process and in turn, more nitrogen can be available to the plants (Pinto, 1997). Besides, the reduction in the leaching improves nitrate retention, educing nitrogen loss in the soil profile.

Early and Total Yield

The effect of different treatments on cucumber early and total yield was presented in Table (3). Referring to the effect of different mulch color, data showed that using transparent mulch increased significantly early and total yield weight followed by black mulch. Regarding the effect of different phosphorus levels on early and total yield, data showed that the highest early and total yield weight were obtained by 60 ppm followed by 40 ppm with significant difference between them. The lowest early and total yield was obtained by 20 ppm. Regarding the interaction effect between different mulch color and phosphorus levels, data showed that using transparent mulch combined with60 ppm phosphorus increased significantly early and total yield followed by black mulch combined with60 ppm, but there was no

significantly difference between 40 and 20 ppm with green and blue mulch colors. The lowest yield was obtained by control (without mulch) with 20 ppm.

The increase in yield might be due to the increasing utilization of N fertilizer that stimulating meristimatic activities. The accumulation of synthesized metabolites resulted in high dry matter accumulation and finally high yield (Salman *et al.*, 1992). Increased yield could be largely attributed to the increase in soil temperature due to application of mulch which resulted in enhancement of soil environment around roots of cucumber plants, which led to increasing plant growth, and hence increasing nutrient absorption and uptake. These results were in line with those obtained by (Salman *et al*, 1991).

Mineral contents

According to the effect of mulch color, data in Tables (4) showed that using transparent color led to increase N, P and K % significantly in cucumber leaves followed by black color with significant difference between them. On the other hand, there was no significant difference between green and blue mulch colors. The lowest N, P and K % was obtained from the control (without mulch).

Concerning of the effect of applied phosphorus levels on N, P and K % in cucumber leaves, the highest N, P and K % was observed from using 60 ppm followed by 40 ppm with significant difference between them. The lowest N, P and K % was obtained by applying 20 ppm.

Fig 1. The Average soil temperature (°C) at 15 (cm) depth under different mulch treatments during February, March and April 2007.

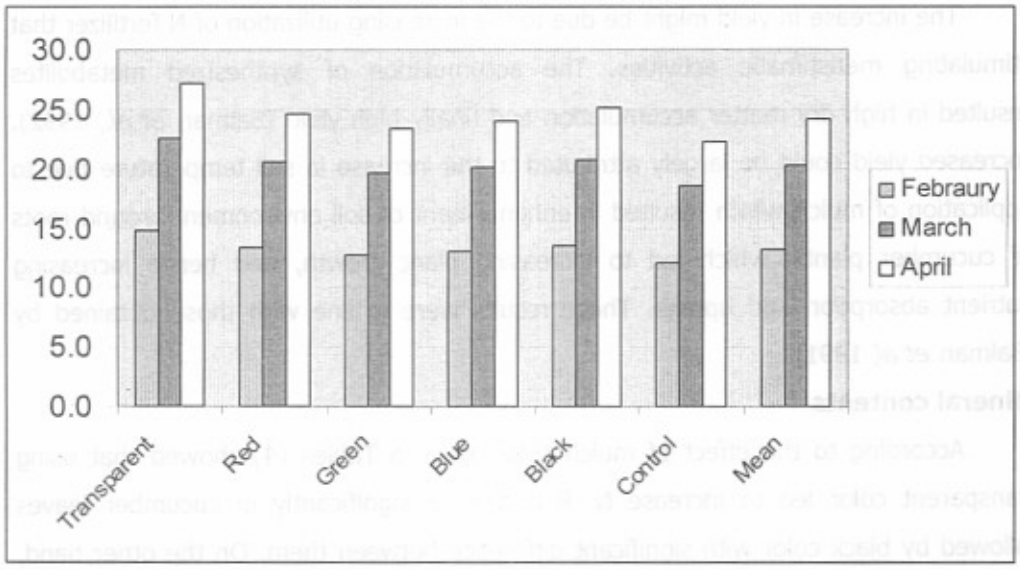

Fig 2. The Average soil temperature (°C) at 15 (cm) depth under different mulch treatments during February, March and April 2008.

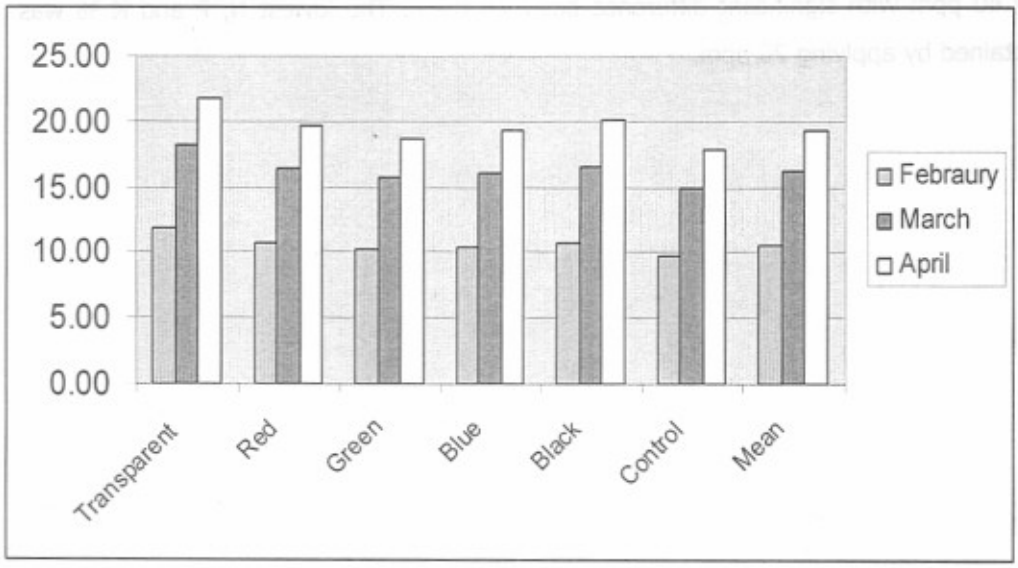

Table 1. Cucumber plant height, number of leaves and total leaf area per plant affected by different mulch color and phosphors levels.

Phosphors levels / Mulch treatments	2007				2008			
	Plant Height (cm plant)							
	20 ppm	**40 ppm**	**60 ppm**	**mean**	**20 ppm**	**40 ppm**	**60 ppm**	**mean**
Transparent	230 f	278 b	288 a	265 A	212 f	245 b	253 a	237 A
Red	237 e	240 e	258 d	244 C	211 f	219 e	227 d	219 C
Green	206 hi	211 h	219 gh	212 D	181 hi	193 g	196 g	190 D
Blue	208 hi	215 gh	221 g	214 D	183 hi	194 g	199 g	192 D
Black	227 f	266 c	277 b	256 B	207 f	234 c	244 b	229 B
Control	202 ij	198 j	209hi	203 E	174 j	178 ij	193 g	182 E
mean	218 c	235 b	245 a		195 C	210 B	219 A	
	Number of levels / plant							
	20 ppm	**40 ppm**	**60 ppm**	**mean**	**20 ppm**	**40 ppm**	**60 ppm**	**mean**
Transparent	47.2 e	57.2 b	59.1 a	54.5 A	43.2 d	49.7 b	51.8 a	48.1 A
Red	45.6 f	49.1 d	53.1 c	49.3 C	41.4 e	42.9de	46.1 c	43.5 C
Green	42.3gh	43.3 g	44.9 f	43.5 D	36.8 h	38 gh	39.8 fg	38.7 D
Blue	42.7gh	44.8 f	45.4 f	44.3 D	37.2 h	39.5fg	40.4 e	39.0 D
Black	46.5 ef	54.6 f	57.1 b	52.7 B	42.1 de	47.6 c	49.6 b	46.5 B
Control	40.7 i	41.5 hi	42.9gh	41.7 E	35.4 i	36.1 hi	39.3 fg	36.9 E
mean	44 C	48 B	50 C		39 C	42 B	45 C	
	Total leaf area (cm^2) / plant							
	20 ppm	**40 ppm**	**60 ppm**	**mean**	**20 ppm**	**40 ppm**	**60 ppm**	**mean**
Transparent	9870 f	11930b	12359a	11387A	8790 e	10118b	10482a	9797A
Red	9523 g	10399e	11072d	10299C	8417fg	8735 e	9390 d	8848C
Green	8840 i	9057 h	9398 g	9099 D	7498 i	7971 h	8127gh	7866D
Blue	8926hi	9363 g	9484 g	9258 D	7570 i	8044 h	8218gh	7945D
Black	9722fg	11415c	11930b	11023B	8575ef	9681 c	10108 b	9459B
Control	8497 j	8668 i	8982hi	8716 E	7106 j	7352 i	7999 h	7519E
mean	9229 C	10122B	10537A		8009 C	8650 B	9055 C	

Table 2. Cucumber canopy fresh and dry weights affected by different mulch color and phosphors levels.

Phosphors levels / Mulch treatments	2007				2008			
	Canopy fresh weight (g / plant)							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	897 f	1085b	1124 a	1035A	799 e	920 b	953 a	891A
Red	866 h	936 e	1007 d	936 C	765 g	794 e	854 d	804C
Green	804 j	823 j	854 hi	827 D	682 k	725 j	739 hi	715D
Blue	811 j	851 i	862 hi	842 D	688 k	731 ij	747 h	722D
Black	884 g	103c	1077 b	1002B	780 f	880 c	918 b	860B
Control	772 l	788 k	817 j	792 E	655 l	668 k	727 j	684E
mean	839 C	920 B	958 A		728 C	786 B	823 A	
Canopy dry weight (g / plant)								
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	112.1 e	135.6b	140.5 a	129 A	99.9 e	114.9 b	119.1 a	111A
Red	108.2fg	117.1d	125.8 c	117 C	95.7ef	99.3 e	106.7 d	101C
Green	100.5hi	102.9h	106 g	103 D	85.2 i	90.6 h	92.4 gh	89 D
Blue	101.4hi	106.4g	107.8fg	105 D	86.1 i	91.4 h	93.4 fgh	90 D
Black	110.5ef	129.7c	133.6 b	125 B	97.5ef	110 c	113.9 b	107B
Control	94.6 j	98.5 i	102.1 h	99 E	80.5 j	83.59 i	90.9 h	85 E
mean	107.1 C	113.5B	119.1 A		94.9 C	96.2 B	101.1 A	

Table 3. Cucumber early and total fruit weight per plant affected by different mulch color and phosphors levels.

Phosphors levels / Mulch treatments	2006				2007			
	Early Fruit weight (g/plant)							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	688 c	773 b	843 a	768 A	612c	688 b	751 a	684 A
Red	535 f	601 e	642 d	593 C	476 f	535 e	571 d	527 C
Green	438 i	492 g	538 f	489 D	390 i	438 g	479 f	435 D
Blue	436 i	489 g	534 f	486 D	388 i	436 g	475 f	433 D
Black	555 f	624 d	678 c	619 B	494 f	555 d	603 c	551 B
Control	409 j	459 h	413 j	427 E	364 j	409 h	368 j	380 E
mean	510 C	573 B	608 A		454 C	510 B	541 A	
Total Fruit weight (g/plant)								
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	3821 c	4293 b	4686 s	4267 A	3401 c	3820 b	4170 a	3797 A
Red	2971 f	3338 e	3567 d	3292 C	2644 f	2970 e	3175 d	2930 C
Green	2433 i	2734 g	2987 f	2718 D	2166 i	2433 g	2658 f	2419 D
Blue	2420 i	2719 g	2964 f	2701 D	2154 i	2419 g	2637 f	2404 D
Black	3084 f	3465 d	3767 c	3439 B	2745 f	3084 d	3353 c	3060 B
Control	2270 j	2550 h	2296 j	2372 E	2020 j	2269 h	2043 j	2111 E
mean	2833 C	3183 B	3378 A		2522 C	2833 B	3006 A	

Table 4. Cucumber leaves mineral contents N, P and K % affected by different mulch color and phosphors levels.

Phosphors levels / Mulch treatments	2007				2008			
	N %							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	4.33 e	5.09 b	5.34 a	4.92 A	3.94 e	4.63 b	4.86 a	4.48 A
Red	3.87 g	4.55 d	4.78 c	4.39 C	3.52 g	4.14 d	4.35 c	4.01 C
Green	3.24 i	3.81 g	4.01 f	3.68 D	2.98 ij	3.47 g	3.64 f	3.35 D
Blue	3.15 j	3.71 h	3.89 g	3.59 D	2.87 k	3.38 h	3.55 g	3.26 D
Black	3.84 g	4.52 d	4.75 c	4.37 B	3.50 g	4.11 d	4.32 c	3.98 B
Control	2.70 k	3.18 j	3.34 i	3.07 E	2.46 l	2.89 jk	3.04 i	2.78 E
mean	3.52 C	4.14 B	4.35 A		3.20 C	3.77 B	3.96 A	
	P %							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	0.85 de	0.94 b	0.98 a	0.92 A	0.75 d	0.84 b	0.87 a	0.82 A
Red	0.76 g	0.84 e	0.87 d	0.82 C	0.67 f	0.75 d	0.77 d	0.73 C
Green	0.68 i	0.76 g	0.79 fg	0.74 D	0.61 g	0.68 f	0.71 e	0.66 D
Blue	0.67 ij	0.73 h	0.77 g	0.72 D	0.59 g	0.66 f	0.68 f	0.65 D
Black	0.81 f	0.90 c	0.93 b	0.88 B	0.72 e	0.80 c	0.83 b	0.78 B
Control	0.58 k	0.64 j	0.66 ij	0.63 E	0.51 i	0.58g	0.59 g	0.56 E
mean	0.72 C	0.80 B	0.83 A		0.64 C	0.71 B	0.74 A	
	K %							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	3.50 d	3.87 b	3.93 a	3.77 A	3.33 d	3.68 b	3.73 a	3.58 A
Red	3.13 fg	3.46 d	3.51 d	3.37 C	2.97 fg	3.29 d	3.34 d	3.20 C
Green	2.82 h	3.12 fg	3.17 f	3.04 D	2.68 h	2.96 fg	3.01 f	2.88 D
Blue	2.75 i	3.04 g	3.09 fg	2.96 D	2.61 h	2.89 g	2.93 fg	2.81 D
Black	3.36 e	3.71 c	3.77 c	3.61 B	3.19 e	3.52 c	3.58 c	3.43 B
Control	2.36 k	2.61 j	2.65 j	2.54 E	2.24 j	2.48 i	2.51 i	2.41 E
mean	2.99 C	3.30 B	3.35 A		2.84 C	3.14 B	3.19 A	

Table 5. Cucumber phosphorus use efficiency (PUE) affected by different mulch color and phosphors levels.

Phosphors levels / Mulch treatments	2006				2007			
	PUE							
	20 ppm	40 ppm	60 ppm	mean	20 ppm	40 ppm	60 ppm	mean
Transparent	76.4 a	45.2 e	31.2 g	50.9 A	68.1 a	40.2 e	27.8 g	45.3 A
Red	59.4 c	35.1 f	23.8 j	39.4 C	52.9 c	31.3 f	21.2 j	35.1 C
Green	48.7 d	28.8 h	19.9 k	32.5 D	43.3 d	25.6 h	17.7 k	28.9 D
Blue	48.4 d	28.6 h	19.8 k	32.3 D	43.1 d	25.5 h	17.6 k	28.7 D
Black	61.7 b	36.5 f	25.1 j	41.1 B	54.9 b	32.5 f	22.4 j	36.6 B
Control	45.4 e	26.8 i	15.3 l	29.2 E	40.4 e	23.9 i	13.6 l	25.9 E
mean	56.7 A	33.5 B	22.5 C		50.4 A	29.8 B	20.1 C	

Referring to the interaction effect between mulch color and phosphorus level, data showed that using transparent color combined with 60 ppm increased N, P and K percentage in cucumber leaves.The lowest N, P and K % in cucumber leaves proceeded by control with 20 ppm.

The higher NPK absorption may be favored by the increase in the soil temperature and moisture availability (under mulch conditions) caused by the plastic mulch that led to greater vegetative growth. This lower temperature may negatively influenced the nitrogen absorption (Pinto, 1997).

At low temperatures, the structure of membrane lipids in roots also changes, and the activities of enzymes on the membrane responsible for nutrient uptake such as H +-ATPase decrease and then reduce nutrient uptake by root system (Ryyppo *et al*,. 1994). In general, low soil temperature will reduce root function and therefore nutrient uptake will decrease concomitantly.

Phosphorus use efficiency (PUE)

According to the effect of mulch color and phosphorus level, data in Tables (5) showed that the phosphorus use efficiency (PUE) was greatest at the lowest dose of P and decreased as the P levels were increased. However, the increased levels of P up to 60 ppm, significantly improved the yield. The application of mulching materials in general, and transparent color in particular, significantly increased the phosphorus use efficiency and the productivity. These results were in line with those obtained by Kogbe and Adediran, 2003.

CONCLUSION

The method of using mulch to grown cucumber in winter season has a significant effect on the growth and yield. Phosphorus with 60 ppm gave significantly higher values of yield and nutrition uptake. PUE was greatest at 20 ppm dose of P and decreased as the P levels were increased. The mulch transparent and black colors were the most effective and to be recommended effected color can be using compared to uncovered soil and other mulch color.

REFERENCES

1. Chapman, H. D. and F. Pratt. 1961. Methods of Analysis for Soils, Plants and Water.*Univ. of Calif.*, 35: 6 - 7.
2. FAO, 1980. Soil and Plant Analysis. *Soils Bulletin* 38: 2-250.
3. Fonsecal, I. C. and B. A. E. Klar, R. Goto, C. S. V. J. Neves1. 2003. Colored polyethylene soil covers and grafting effects on cucumber flowering and yield. *Scientia Agricola*, 60: 643-649.
4. Kogbe J. O. S. and J. A. Adediran. 2003. Influence of nitrogen, phosphorus and potassium application on the yield of maize in the savanna zone of Nigeria. *African Journal of Biotechnology* Vol. 2 (10), pp. 345-349.
5. Lippert, T.L.H. and F.L. Witing. 1964. Soil moisture under bands of petroleum and polyethylene mulches. Proc. Amer. *Soc. Hort. Sci.* 85: 541-546.
6. Maged, A. El-Nemr. 2006 . Effect of Mulch Types on Soil Environmental Conditions and Their Effect on the Growth and Yield of Cucumber Plants. *Journal of Applied Sciences Research* 2(2): 67-73.
7. Pinto, J.P. 1997. Efeito de tipos de coberturas de polietileno preto na evapotranspiração e na produção da cultura de alface. Viçosa,. 55p. Dissertação (M.S.) - Universidade Federal de Viçosa.
8. Romic, M. Romic, J. Borosic and M. Poljak. 2003. Mulching decreases nitrate leaching in bell pepper (Capsicum annuum L.) cultivation . *Agricultural Water Management.* Vol 60, Issue 2, 23 ,Pages 87-97 .
9. Ryyppo, A., E.M. Vapaavuori, R. Rikala and M.-L. Sutinen. 1994. Fatty acid composition of microsomal phospholipids and H+-ATPase activity in roots of Scots pine seedlings grown at different root temperatures during flushing. *J. Exp. Bot.* 45: 1522–1539.
10. Salman, H.M. and S.F. Gorski. 1985. The effect of clear and black polyethylene mulches on the soil environment. Res. Circular, Ohio *Agric. Res. and Devlopment Center.*, 288: 7-9.

11. Salman, S.R., A.F. Abou-Hadid, M.O. Bakry and, A.S. El-Beltagy. 1991. The effect of plastic mulch on the microclimate of plastic house. *Acta Hort.* 287: 417-425.
12. Salman, S. K., A. F. Abou-Hadid, I. M. J. Beltagy and A. S. Beltagy, 1992. Plastic House Microclimate as Affected by Low Tunnels and Plastic mulch. Egyptian *J. of Hort.* 2: 111-119.
13. SAS Institute. 1999. SAS User's guide: Statistics SAS Inst., Cary, N.C.
14. Soltani, N., J. L. Anderson, A.R. Hamson. 1995. Growth and analyses of watermelon plants with mulches and row covers. *J. Am. Soc. Hort. Sci.,* 120:1001 – 1009
15. Tagliavini, M., E.J. Hogue and G.H. Neilson. 1991. Influence of phosphorus nutrition and root zone temperature on growth and mineral uptake of peach seedlings. *J. Plant Nutr.* 14:1267–1276.
16. Teasdale J.R. and Abdul-Baki A.A. 1995. Soil temperature and tomato growth associated with black polyethylene and hairy vetch mulches. *J. Amer. Soc. Hort. Sci.* 120(5): 848–853.
17. Toselli, M., J.A. Flore, B. Maragoni and A. Masia. 1999. Effects of root-zone temperature on nitrogen accumulation by non-bearing apple trees. *J. Hort. Sci. Biotech.* 74:118–124.
18. Vasilieva, G., N. Mironomva and A. Glyanko. 1999. Low above-zero temperature effect in the root zone on nitrate reductase activity and nitrate content in pea organs with stage of growth. *J. Plant Nutr.* 22:967–976.

استجابة نباتات الخيار لألوان غطاء التربة و الفوسفور تحت الصوب

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المعمل المركزي للمناخ الزراعي ــ مركز البحوث الزراعية ــ الدقي ــ جيزة

تم التجربة خلال موسمى ٢٠٠٧ و ٢٠٠٨ فى موقع البوصيلى للزراعات المحمية التابع لمركز البحوث الزراعية بمحافظة البحيرة واجريت التجربة فى صوب غير مدفأة لتحديد تاثير الوان التغطية بالبلاستك و مستويات من الفوسفور على نمو وانتاج نباتات الخيار. تم زراعة نباتات الخيار صنف برنجى ٨٢ فى تربة رملية. وتم تغطية الصوب ببلاستيك مصنوع من مادة البولى اثيلين سمك ٢٠٠ ميكرون معامل ضد الاشعة فوق البنفسجية وعرضة ٥,٢٥ م. تم استخدام خمس معاملات من الوان التغطية بالبلاستك (احمر و اخضر و ازرق و اسود و شفاف) مع كنترول بدون تغطية وثلاث معاملات من الفوسفور اضيفت الى ماء الرى بمعدل ٢٠ و ٤٠ و ٦٠ جزء فى المليون تحت اللوان التغطية المختلفة.تم قياس درجة حرارة التربة على عمق ١٥ سم لكل لون من ألوان التغطية. وتقدير صفات (طول النبات وعدد الاوراق و الوزن الطازج و الجاف للنبات) والمحصول المبكر والكلى. وقد دلت النتائج على ان درجة حرارة التربة كانت اعلى تحت لون التغطية بالشفاف يتبعها اللون الأسود عن باقي المعاملات وكذلك الكنترول. وكانت افضل نتائج لنمو النباتات من حيث طول النبات وعدد الاوراق ومساحة الورقة والوزن الطازج والجاف والمحصول فى معاملة التغطية بالشفاف يتبعها الاسود مع وجود فرق معنوى بينهما. زاد محتوى الأوراق من النتروجين والفوسفور والبوتاسيوم من معاملة التغطية بالشفاف يتبعها التغطية بالأسود مع وجود فرق معنوى بينهم كانت كفاءة استخدام الفوسفور عالية مع مستوى الفوسفور الاقل وهو ٢٠ جزء فى المليون ومع ارتفاع مستوى الفوسفور تقل كفاءة استخدام الفوسفور معنويا. وعكس ذلك بزيادة مستوى الفوسفور يزيد النمو الخضرى والمحصول معنويا. التفاعل بين لون التغطية ومستويات الفسفور اعطى اعلى نمو خضرى ومحصول فى معامل لون التغطية الشفاف مع مستوى ٦٠ جزء فى المليون فسفور مع وجود فرق معنوي بينها وبين باقى المعاملات.