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SUPPLEMENTAL IRRADIATION OF PETUNIA CV. 'RED FLASH' FROM POST-GERMINATION TO TRANSPLANT

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Introduction

Previous research has focused on supplemental irradiation of *Petunia* from germination to flower (1). This work was often done in growth chambers, limiting the practical application. It has been established that *Petunia* plants photoperiodically flower earlier under long days (4). Lamp type has produced different effects (2). Increased lateral branching occurs under short days, but also will occur if the plants receive long days with both fluorescent and incandescent lamps (1, 2). Incandescent lamps cause tall plants (2), while High Pressure Sodium Vapor (HPS) lamps prove to be most effective in growing a high quality plant that flowers early (1).

The objective of this project was to determine the optimum procedure to supplement solar radiation on *Petunia* seedlings for maximum growth. The project studied four factors in the first twenty days after germination: 1) seeding date, 2) lamp type, 3) supplemental duration, and 4) the time after germination when supplementing was critical. After the first twenty days the plant is ready to transplant, and there is no apparent economic benefit to a supplemental treatment after transplanting. The stage of development when early seedling development can effectively respond to supplemental irradiation is vitally important to the economic viability of the procedure. If plants must be irradiated for long periods, the costs may make supplemental irradiation uneconomical. Various researchers have shown that fluorescent lamps are an excellent source of radiation for *Petunia* growth, but HPS is commercially more acceptable (3). Finally, it is critical to know whether the response is enhanced by natural day length, or is due to the longer day occurring with 16 and 24 hour treatments.

Materials and Methods

Petunia cv. 'Red Flash' seed were sown into pacs, three times, once each in January, February and March, placed under mist at 68F, and allowed to germinate. Within ten days after sowing, germination had occurred and pacs were moved to a 55F night temperature. Pacs were placed under supplemental sources and photoperiods as described in Fig. 1. When not under a light treatment, the seedlings are grown under natural day conditions (Fig. 2). After the

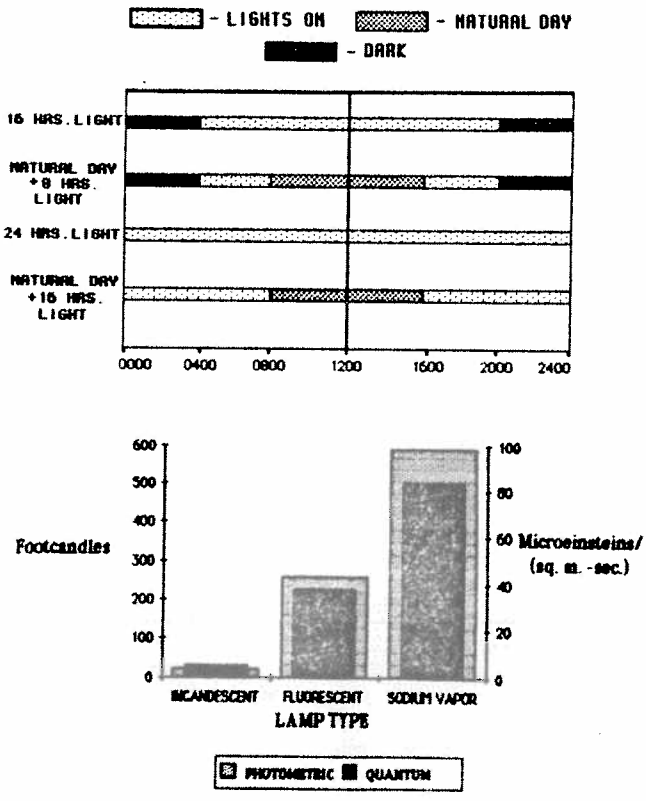

Fig. 1: Four duration treatments and irradiance levels recorded when *Petunia* 'Red Flash' was grown under three supplemental radiation sources.

[1]*Undergraduate student and assistant professor, respectively.*

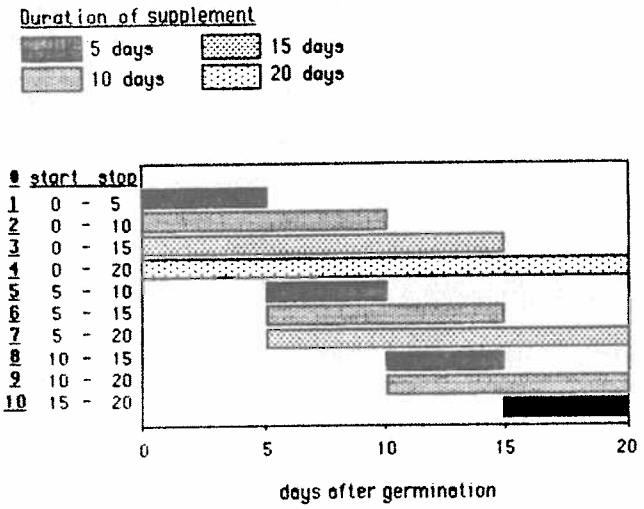

Fig. 2: Duration and timing of supplemental irradiation treatments during the first twenty days after germination of *Petunia* 'Red Flash'.

first true leaf appeared, the pacs were thinned to approximately 24 plants per pac.

Other than altering irradiation treatment, the environmental conditions remained the same. Plants were fertilized with each watering with the CSU fertilizer solution (CGGA Bull. 413). The soil mix was 1:1 peat and vermiculite (by volume), amended with 7 oz/bu ground limestone, 0.7 oz/bu magnesium sulfate, and 0.42 oz/bu superphosphate. Supplemental CO_2 was used during the daylight hours to maintain a maximum level of about 400 ppm.

On the 21st day after germination, when the lighting treatments were complete, six seedlings were planted into cell pacs to grow until flowering. The remaining 18 plants were oven dried for 48 hrs at 70F and weighed. There were three pacs per treatment. The cell pacs were grown at 61F night/70F day temperature until the first flower in a pac opened. Analysis of variance was used to test for significance.

Results

All treatments were in a factorial arrangement. Since the interactions were not statistically significant, only the main effect of each factor is presented. Each sowing (Jan., Feb., Mar.) produced results suggesting that supplemental treatments were most beneficial during January (Table 1). The differences due to an artificial supplement were less obvious in the March sowing. The January sowing had marked visual differences. Plants treated to 24 hours continuous irradiation under HPS flowered 11 days earlier than those under natural days. Plant weight was 47% greater. The February and March plantings showed little or no difference when compared to their respective controls. As summer approached, solar radiation increased, and there was no apparent benefit from supplemental irradiation. Supplemental irradiation benefits the grower who starts the bedding plant season in the January to February period in Colorado.

The supplemental irradiation was either incandescent, fluorescent, or HPS. Fig. 3 illustrates the overall effect of

Table 1: Days to flower and plant weight of *Petunia* 'Red Flash' when plants were sown monthly and given supplemental irradiation compared to those grown without supplement.

Month	Supplemental Irradiation	Natural Day
	Days to Flower	
January	57	68
February	53	52
March	43	43
	Plant Weight (mg)	
January	200	130
February	220	210
March	230	270

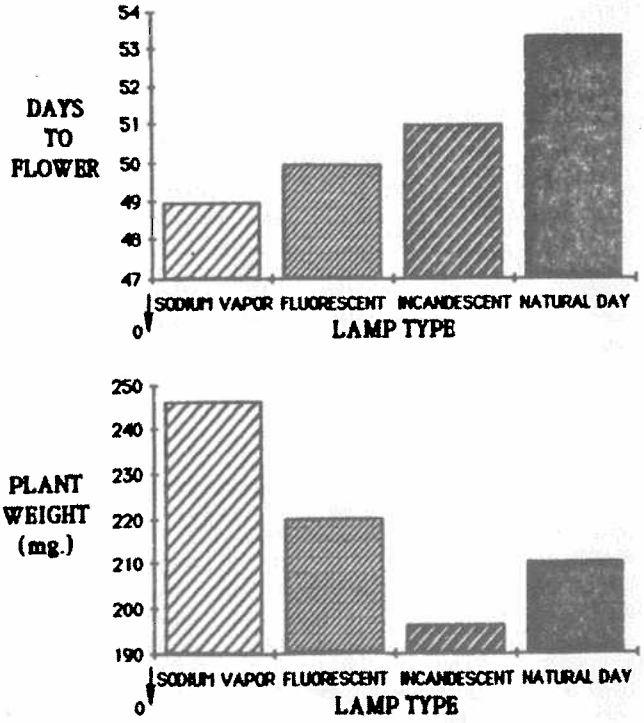

Fig. 3: Days to flower and plant weight of *Petunia* 'Red Flash' when grown under different radiation sources, all treatments combined.

supplemental irradiation on plant growth. The HPS-treated plants weighed more and flowered earlier than plants grown under incandescent or fluorescent sources. Plants grown under any HPS treatment, regardless of irradiation treatments, or time of planting, flowered earlier (Table 2). HPS had two additional advantages: plant temperatures were higher under HPS, and operational costs were less (3).

The four durations used were 24 hrs continuous, 16 hrs continuous supplemental irradiation, and the natural day plus supplemental irradiation to equal 16 or 24 hrs duration. Fig. 4 shows that when plants were grown under 24 hrs continuous radiation, they flowered earlier and plant weight at the transplanting time was increased compared to plants in the other treatments. There was no difference between the two 24 hr and two 16 hr duration treatments.

Table 2: Days to flower and plant weight of *Petunia* 'Red Flash' when subjected to varying supplemental irradiation treatments. 24H and 16H represent the number of hours of continuous supplemental irradiation. 24H:ND and 16H:ND represent treatments where supplemental irradiation was used to increase the length of the natural day to equal the number of hours specified.

Treatment		Incandescent				Fluorescent				Sodium Vapor			
Number	Days	24H	24H:ND	16H	16H:ND	24H	24H:ND	16H	16H:ND	24H	24H:ND	16H	16H:ND
						Days to Flower							
1	0-5	51	50	53	53	53	53	51	54	53	55	54	53
2	5-10	48	48	50	49	48	47	48	49	48	51	49	49
3	10-15	50	47	49	48	49	47	48	49	46	47	47	46
4	15-20	53	48	51	49	49	47	49	48	47	50	48	47
5	0-10	49	50	47	49	47	47	48	49	48	48	45	49
6	5-15	51	52	56	54	50	53	53	53	51	50	48	51
7	10-20	52	53	50	50	50	50	52	52	50	48	48	49
8	0-15	52	50	55	52	52	48	53	51	46	52	51	50
9	5-20	53	52	51	52	48	48	51	49	48	47	48	50
10	0-20	50	49	51	52	48	49	49	49	45	45	47	50
						Plant Weight (mg)							
1	0-5	204	218	202	198	223	228	223	191	256	229	216	200
2	5-10	221	219	231	230	216	243	204	221	229	218	216	225
3	10-15	205	202	224	222	198	252	178	198	286	227	209	251
4	15-20	183	188	158	179	200	218	212	167	261	199	211	199
5	0-10	196	193	175	228	252	230	203	244	249	287	265	187
6	5-15	184	200	175	185	222	249	196	200	260	218	255	211
7	10-20	216	204	195	205	198	218	190	202	298	198	222	196
8	0-15	195	209	168	189	222	257	215	204	314	263	231	225
9	5-20	197	179	174	208	263	231	208	191	323	275	282	229
10	0-20	195	201	169	177	250	270	233	243	349	306	277	212

Natural Day Treatment: 53 days to flower, 210 mg.

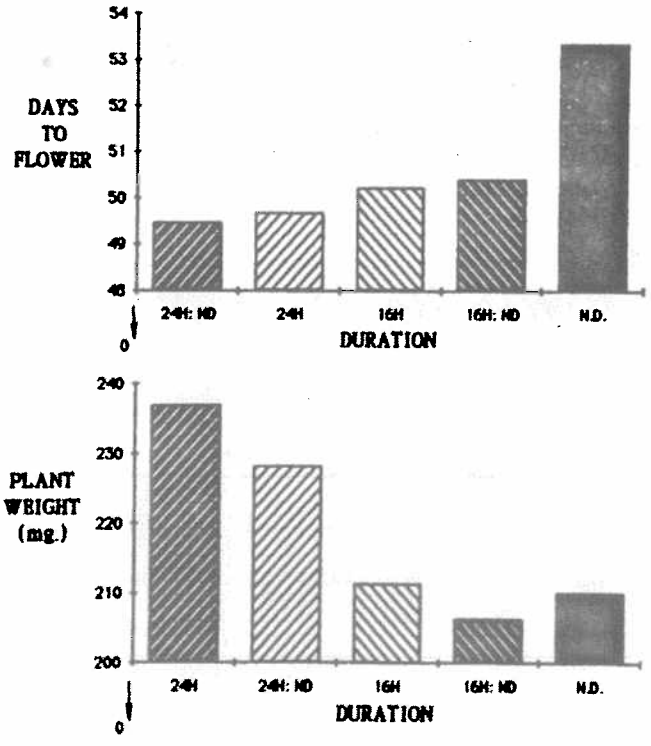

Fig. 4: Days to flower and plant weight of *Petunia* 'Red Flash', when plants were irradiated 24 hours continuously (24H), 16 hours continuously (16H), or subjected to the natural day (ND) plus supplemental radiation to equal 16 hours (16H:ND) or 24 hours (24H:ND).

The timing of the supplemental radiation treatments was the most complicated aspect of the experiment (Fig. 2). The plants remained under the treatments for a period of either 5, 10, 15, or 20 days, and were started 0, 5, 10, or 15 days after germination. *Petunias* were subjected to natural days when not in any radiation treatment. Plants were most responsive to the treatment 10 days after germination (Fig. 5). Flowering was not hastened when the plants were treated during the first five days after germination, and flowering was delayed if the plants were given the treatment after the 15th day. The greatest dry weight accumulation occurred when the plants were irradiated 20 days (Fig. 5)

Conclusion

To summarize, use

1) *High Pressure Sodium Vapor Lamps*, with
2) *24 Hour Continuous Lighting*, and
3) *Irradiate Day Ten to Fifteen After Germination.*

Fig. 6 illustrates the differences that were obtained with this recommendation, assuming it was used during any of the three seedings. On the average, the plants flowered seven days earlier and weighed 36% more than the natural day control.

Literature Cited

1) Carpenter, W.J., W.H. Carlson, 1974, Comparison of photoperiodic and high intensity lighting on the growth and flowering of *Petunia hybrida Vilm.* The Michigan Florist. April, 16-20.

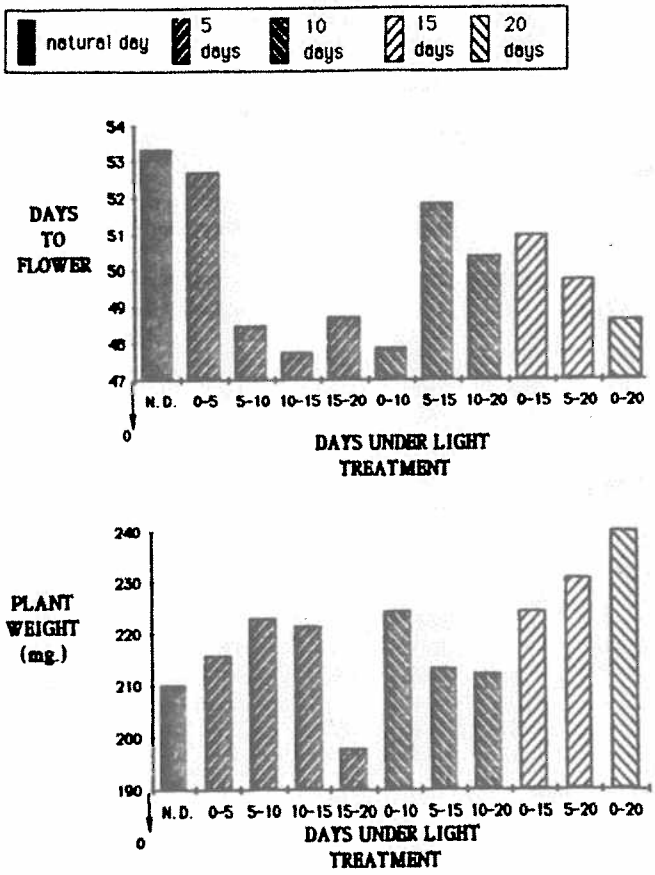

Fig. 5: Days to flower and plant weight of *Petunia* 'Red Flash' under each of the ten timing treatments (Main effects).

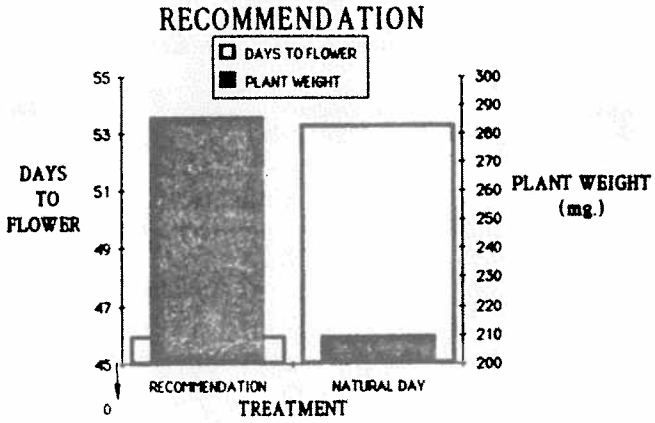

Fig. 6: Optimum treatment response compared to plant response under natural days. *Petunia* 'Red Flash' plants were given 24 hours continuous radiation under HPS lamps for 5 days, from 10 to 15 days after germination.

2) Mastalerz, John W., 1963, Controlling growth of *Petunias*. Penn. Flow. Grow. Bul. 145:4-5,9.

3) Norton, Robert A., 1979, Commercial lighting of bedding plants, Florists Review, 163:4231, 24-25, 60-62, January 4.

4) Piringer, A.A., H.M. Cathey, 1960, Effect of photoperiod, kind of supplemental light and temperature on the growth and flowering of *Petunia* Plants, Proc. Amer. Soc. of Hort. Sci., 76:649-660.