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Influence of Different Irrigation Intervals on Growth and Yield of Bell Pepper (*Capsicum Annuum* Grossum Group)

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Abstract: To evaluate the effect of different irrigation intervals on bell pepper (*Capsicum annum* Grossum group) a study was carried out in the Research Area, Department of Horticulture, University of Arid Agriculture, Rawalpindi, during 2002. Treatments used were control, irrigation after 3 days interval, 6 days interval, and 9 days interval Results revealed that Maximum seedling survival percentage 93 % was observed in plots with 3 days of irrigation interval followed by 85% in treatments with 6 days interval. It was observed that the maximum plant height (cm), Number of leaves plant^{-1} and leaf area (cm^2) were significantly higher in plants where irrigation applied after 3 days of intervals than other treatments. Regarding the reproductive parameters of bell pepper maximum number of flower per plant, number of fruit per plant and fruit weight per plant observed with 3 days of irrigation intervals. As follow up the crop growth and production of fruit it is also found the plot where irrigation applied after 3 days of intervals gave highest yield. It is concluded that 3 days of irrigation interval is a better irrigation interval as compared to other treatments applied for the plant growth and fruit yield under the climatic conditions of Rawalpindi.

Key words: Bell Pepper, Irrigation intervals, Yield, and Economic Comparison

INTRODUCTION

Bell pepper (*Capsicum annum* Grossum group) belongs to the family Solanaceae, which is an important group of vegetables cultivated extensively in Pakistan and also widely cultivated in almost every country of the world. Bell pepper is summer crop and its total cultivated area under production in Pakistan is about 91800 hectare, with total production of 115 (000 tonnes)[4]. It thrives best in warm climate, where frost is not a problem during growing seasons. In general it requires temperature ranging 25-35°C. It requires well drained silt or clay loam, where water logged and alkaline soils are not suitable for its production. Bell pepper plant requires large quantity of readily available soil nutrients with optimum soil moisture and favorable climatic conditions. Unfavorable temperature and water supply are main causes of bud, flower and fruit drop[11]. Fertilizer requirements for Bell pepper depend on different soil condition, about 400 pounds per acre of 20 percent super phosphate will be sufficient for better crop production[7].

Like environmental and topographical factors, irrigation is an important factor, which effects the yield and quality of bell pepper. Irrigation frequencies or different irrigation intervals have beneficial effects on water balance, fruit quality and fruit production[5]. Irrigation plays important role in maintain sustainable growth of every crop especially it reduces the wilting which caused 60- 80% crop loss. But some time excessive water or frequent flooding for longer periods of time affect the yield of the crop[3]. At present, there is need to improve vegetable production and derive ways through which maximum benefits can be obtained from the limited available water resources. In this regard under Rawalpindi conditions, there is a need to standardize production technology under local climatic and edaphic conditions so that the farmers of the area can get maximum benefits from the crop production with limited irrigation resources. by realizing the effect of different irrigation intervals on growth and yield of bell pepper, the study is carried out with following objective; (i) to evaluate the yield potential of bell pepper under different irrigation intervals.

MATERIALS AND METHODS

Field experiment was carried out in the Research Area of the Department of Horticulture, University of Arid Agriculture, Rawalpindi, during 2001-2002. The experiment was laid out using Randomized Complete Block Design (RCBD) with factorial arrangements. Bell pepper crop was

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Table 1: Physical and Chemical Characteristics of Crop Experimental Soil

Soil Characteristics	Unit	Value
Texture		
Sand	%	55
Silt	%	32
Clay	%	13
Textural Class	Sandy loam	
pH	7.8	
Ec_e	dSmG^{1}	0.33
Nitrogen	g100gG^{1}	0.13
Available Phosphorus	mg kgG^{1}	4.50
Potassium	mg kgG^{1}	118
Organic Matter	g100gG^{1}	0.83

evaluated for the growth and yield under different treatments of irrigation intervals: control (no irrigation), irrigation after 3, 6, 9 and 12 days intervals. For nursery raising, bell pepper seeds were sown on early February, 2002 in raised bed. A field plot measuring approximately 80 m2 was prepared, in this plot sub plot measuring 2 x 2 m were raised and seedling of bell pepper were transplanted by keeping plant to plant distance 30 cm and row to row distance at 60 cm. Recommended NPK were applied to all treatments in the form of Urea, Di Ammonium phosphate and Sulphate of Potash, at the time of field preparation. Physical and chemical characteristics of experimental soil such as pH, ECe, organic matter, NPK[9] were calculated and presented in Table 1. The experiment repeated thrice with all the treatments.

Crop data: Simple randomization of each plot was done to select five plants and following plant parameters were recorded i.e. Seedling Survival Percentage, Plant height (cm), Number of Leaves plantG^{1}, Leaf area (cm^2), Number of Days to Flowering**,** Number of Flower PlantG^{1}, Number of fruit PlantG^{1}, Fruit Weight PlantG^{1} (g), and Total Yield (kg haG^{1}).

Economic comparison: Benefit cost ratio for each treatment was evaluated. Income calculated on the basis of current local market price of Bell pepper at Rawalpindi during 2002.

Statistical analysis: The data collected for various variables were subjected to statistical analysis using Analysis of Variance (ANOVA) technique. The means were compared by applying Least Significant Difference (LSD) at test5% according toSteel and Torrie[12].

RESULTS AND DISCUSSION

Influence of tretments on vegetative growth: Data regarding to different plant growth parameters represented in table 2. It was evident from the results that 3 days of irrigation interval had significantly effected maximum seedling survival percentage (85.57%), Plant height (98.26 cm), Number of leaves plantG^{1} (171.63) and leaf area (63.05 cm^2). While minimum plant growth observed in plots with treatment control (no irrigation) and irrigation at 12 days intervals. Olalla and Valero[8] reported that bell pepper seedling survival percentage and plant height increased with decrease of irrigation interval and vice versa. Results are also in accordance in case of number of leaves plantG^{1} and leaf area (cm^2) with Channabasavanna and Setty[2]. According to them bell pepper produced more number of leaves per plant with 4 days of irrigation interval and also increased their leaf area. The results clearly indicated those treatments other than 3 day of intervals causing more stress to the plants which lead to the reduction in plant height, number of leaves, leaf area and less production of chlorophyll[1].

Influence of tretments on reproductive growth: Data regarding to different reproductive growth parameters presented in table 3. It was clear from the results that 3 days of irrigation interval had significantly influenced the number of days to flowering, number of flowers plantG^{1} and number of fruit plantG^{1}. Steiner and Akintohi[13] has observed that total plant biomass increased with reducing the irrigation interval up to 5 days, due to more nutrients uptake and higher photosynthesis rates. Irrigation is most important at the time of flower and fruit production. As data in table 3 indicated that minimum days to flowering taken by control (no irrigation) and 12 days of intervals

Table 2: Influence of Irrigation intervals on different growth parameters of bell pepper

Treatments	Seedling Survival percentage	Plant height (cm)	Number of Leaves plant^{-1}	Leaf area (cm^2)
Control (no irrigation)	27.99 de	49.45 d	99.63 d	55.79 c
Irrigation after 3 days intervals	85.57 a	98.26 a	171.63 a	63.05 a
Irrigation after 6 days intervals	78.90 b	90.21 b	160.04 b	59.78a
Irrigation after 9 days intervals	60.75 c	88.81bc	145.71 c	57.93b
Irrigation after 12days intervals	30.89 d	50.09 d	101.21 d	55.23c

Table 3: Influence of Irrigation intervals on different yield parameters of bell pepper

Treatments	Number of Days to Flowering	Number of flower per Plant	Number of Fruits per Plant	Fruit Weight per Plant (kg)	Yield (kg ha^{-1})
Control (no irrigation)	23.21 c	17.13 d	10.75 d	.98 d	22990 d
Irrigation after 3 days intervals	30.88 a	36.39 a	32.78 a	6.79 a	90860 a
Irrigation after 6 days intervals	26.16 b	29.92 b	24.90 b	4.85 b	79056 b
Irrigation after 9 days intervals	25.03 b	24.93 c	19.70 c	2.35 c	51890 c
Irrigation after 12days intervals	23.98 c	18.34 d	12.43 d	1.09 d	24971 d

Table 4: Influence of cost benefit ratio for bell pepper crop

Treatments	Total Income (Rs ha^{-1})	Total Expenditure (Rs ha^{-1})	Cost Benefit Ratio
Control (no irrigation)	31124	23500	1.32
Irrigation after 3 days intervals	70630	30800	2.29
Irrigation after 6 days intervals	50630	29700	1.70
Irrigation after 9 days intervals	42817	27900	1.53
Irrigation after 12days intervals	33353	26500	1.35

respectively. The plants under any kind of stressed conditions tends to shortened their life span and try to complete their life cycle in hasten which causes the minimum days to flowering and fruiting of plants[10].

Influence on yield: Results pertaining to yield of bell pepper kg ha^{-1} were presented in Table 3. Significant differences among the treatments were noticed for yield. Maximum total fruit weight plant^{-1} was obtained with 3 days of irrigation intervals whereas; the minimum fruit weight plant^{-1} was weighed with control treatments. Maximum yield was obtained with 3 days of irrigation intervals; minimum yield was obtained with control treatments. This might be due to better survival percentage, greater number of fruit plant^{-1}and total fruit weight plant^{-1}resulting in greater yield. The results are correlated with the findings of Mohammad and Gamie[6], who observed that bell pepper have different potential of total biomass production and they behave differentially at variable moisture status.

Economic comparison: Data pertaining to economic comparison is presented in table 4. In plots where 3 days of irrigation interval were applied, gave maximum benefit cost ratio i.e. 2.29. While minimum benefit cost ratio 1.3 and 1.35 was obtained from treatments with no irrigation interval and 12 days of irrigation interval respectively. The economic importance of water used can be worked out for specific situation prior to the large scale adoption for commercial plant production. However, the use of irrigation intervals for better growth and higher yield could be economically attractive to reduce the drought stressed conditions in water limiting areas.

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REFERENCES

1. Abdullah, M.M.F., S.A. El-Hadad and M.M. Satour, 2001. Improving vegetable transplants using soil solarization. 7th Conf. Agric. Dev. Res. Fac. Agric. Ain Shams Uni. Cairo. 15(1): 12-14.

2. Channabasavanna, A.S. and R.A. Setty, 2000. Effect of different irrigation intervals on sweet pepper. South-Indian-Hort. 39(5): 296-29.
3. Gajera. M.S., R.P.S. Ahlawat and R.B. Ardeshna, 1998. Effect of irrigation schedule, tillage depth and mulch on growth and yield of winter pea. Indian. J. Agronomy. 43(4): 689-693.([CAB. Abstracts. 1998/08-2000/04)
4. Govt. of Pak, 2001. Agric. Statistics of Pak. Ministry of Food and Agriculture, Islamabad. P. 71-72.
5. Jamiez, R.E., Vielma, F. Rada and N.C. Garcia, 2000. Effect of irrigation frequency on water and carbon relation in three cultivars of sweet pepper. Scientia-Horticultruae. 81(3): 301-308.
6. Mohamed, K.A. and A.A. Gamie, 2000. Studies on some Egyptian onion varieties under Upper Egypt conditions II- effect of irrigation regimes on yield and some bulb quality characters of onion varieties. Assiut J. Agric. Sci. 31(5): 115-127.
7. Nayerabi, S.A.F. and A.H.M. Ahmed, 2001. The Commercial Vegetable of Pakistan Tropical Sci. 41(2): 95 – 99.
8. Olalla, F. and J.A. Valero, 1994. Growth and production of bell pepper under different irrigation intervals. Research-Series-Arkansas-Agri. Expt. Station. 466: 92-95. (CAB Abstracts 1998/08-2000/04)
9. Page, A.L., R.H. Miller and D.R. Keeny, 1982. Methods of soil analysis. Part©II. Chemical and Microbiological properties 2nd ed. Amer. Soc. Agron. Inc. Soil Sci. Sco. Amer. Inc. Madison, Wisconsin, USA.
10. Ponce, M.T., S.G. Selles, E.R. Frreyra, J.M. Peralla, A.S. Moyan and R.P. Ainrichsen, 1996. Metabolic indicators of water deficit as a possible criterion for evaluation of irrigation management analysis in sweet pepper. Agricultrua-Terncia-Santiago. 56(1): 57-63.
11. Rajic, M., M. Skoric, D. Stojilikovic and K.S. Chartzoulakis, 1997. Calculation of irrigation water requirements for sweet pepper and beans. Proceedings of the second international symposium on irrigation of Horticultural Sci. 119(5): 936-939.
12. Steel, R.G.D. and J.R. Torrie, 1980. Principles and Procedures of Statistics. McGraw Hill Book International Company, Singapore. pp. 172-177.
13. Steiner, J.J. and D.C. Akintohi, 1998. Effect of irrigation interval on harvest maturity of onion bulb size. Hort. Sci. 21(3): 1220-1221.