

Effect of soil moisture stress at various growth periods on the yield of chilli (*Capsicum annum L.*) crop.

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ABSTRACT

The field experiment was conducted in summer season on clay soil having depth more than 60 cm at Central Campus, Mahatma Phule Krishi Vidyapeeth, Rahuri to study the effect of soil moisture stress at various growth period of Chilli crop (*Capsicum annum L.*) cultivar Jwala. The maximum yield of green chilli (55.22 q/ha) was observed in control treatment, which was not stressed at any growth period. The minimum reduction in yield was observed in T₂ (7.24 %) where in the stress was exposed during critical growth period (pre flowering) and maximum yield reduction was observed in T₅ (97.49 %) where in the stress was applied in flowering and fruiting stage.

Key words : Yield of Chilli, Soil moisture stress, Soil moisture.

INTRODUCTION

Among the various production components water is the most important. However the water resources are scarce. Hence the efforts are required to the efficient use of water, so as to increase the crop production within the limits of available water resources of the country. There are several ways to use water resources efficiently. Optimum use of water through proper scheduling is one such option. The potential yield of crop can be obtained if there are no constraints inputs required for crop production. However, when the inputs such as waters are scarce, the crop is subjected to stress reducing the yield. The reduction in depends on the degree of stress offered during different crop growth stages. To enable to predict the crop yield due to moisture stress at various growth stages, it is essential to find out the relation of water use and crop yield when the crop is stressed at various growth periods. Several studies are reported on scheduling of irrigation for Chilli (*Capsicum annum L.*). These studies indicated that the use of CW/CPE ratio of 0.6, 0.8 for chilli and irrigation to be applied at 40 % depletion of available soil moisture. However, moisture stress to chilli crop in particular growth stage was not observed. Chilli (*Capsicum annum L.*) is one of the major spices crop. It is used as green chillies or red chillies. The green chillies are rich in vitamin A and C. Therefore considering the importance of crop and its appropriate irrigation scheduling when water is scarce, the field experiment was undertaken to evaluate the effect of soil moisture stress at various growth periods on the yield of chilli crop.

MATERIALS AND METHODS

The experiment was conducted on clay soil having

depth up to 60 cm. The experiment was laid out in randomized block design with seven treatments and four replications. The treatments were as given in Table 1.

The ridges and furrows were prepared at the spacing of 60 cm in each block. The size of the block was 3 x 5 m. The buffer space of 2 m was kept between the treatments and 4 m between the replications. The seedling were prepared on raise bed and transplanted in the first week of February. Standard agronomical practices were followed for the cultivation.

Irrigation Scheduling

Before transplanting of crop, irrigation was applied to the to bring the soil moisture to field capacity. The second irrigation was applied at the transplanting of crop. The next common irrigation to all the treatments was given two days after transplanting for establishment of crop. The subsequent irrigations were scheduled on the basis of soil moisture depletion and stress period of underlying treatments. In control treatment no stress was given during crop growth period. It was considered in this study that the chilli crop was not subjected to stress if irrigated at 40 % depletion of available soil moisture. Therefore, control treatment was irrigated when 40 % of available soil moisture was depleted from the root zone of the crop throughout the crop period. In remaining treatments irrigation were applied at 40 % depletion of available soil moisture except during no irrigation period (stress period). Thus, during this period irrigations were missed (for the period 25 days) When the stress period was over, the irrigation was applied to bring the moisture content to the field capacity and subsequent irrigations were given at 40 % available soil moisture depletion.

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Table 1 : Different treatments and stress period

Treatments	Stress period since transplanting (days)
T ₁ - Control. No stress during entire crop period	-
T ₂ - Stress during pre flowering stage I	1-25
T ₃ -Stress during pre flowering stage II	25-50
T ₄ - Stress during pre flowering & fruiting stage I	50-75
T ₅ - Stress during pre flowering & fruiting stage II	75-100
T ₆ - Stress during pre flowering & fruiting stage III	100-125
T ₇ - Stress during pre flowering & fruiting stage IV	125-150

Soil Moisture

Soil samples were collected at an alternate days from the experimental plots at various depths i.e. 0-20, 20-40, 40-60 cm. The soil samples were collected from one replication of each treatment. It was considered that root zone depth varies accordingly to linear model. Therefore, the soil samples were collected from 0-20 cm depth for 30 days since beginning. The samples were collected at 0-20 cm and 20-40 cm depth from 31st day to 70th day after transplanting. There after the root zone depth was considered as 60 cm and is maximum and samples were collected from 0-20 cm, 20-40 cm and 40-60 cm soil depth. The samples were collected 48 hrs after rainfall or irrigation when irrigation was applied or rainfall occurred. The soil moisture data were used for scheduling i.e. working out 40 % soil moisture depletion during the experimental period.

Harvesting of fruits

Harvesting of green chilli was started about 80 days after transplanting and continued up to the harvest of the crop. During crop period, six pickings of green chilli fruits were done.

RESILTS AND DISCUSSION

Soil moisture status and stress

In control treatment, the crop was not subjected to

stress. Therefore, the soil moisture throughout the crop period was in between field capacity and 40 % depletion. The values of soil moisture at 40 % depletion, field capacity and wilting point were 411.0, 517.7 and 251.0 mm per meter depth of soil, respectively. The soil moisture content in T₂ was below 40 % for 12 days as the stress was imposed during 0-25 days after transplanting. Similarly, the soil moisture content in T₃ was below 40 % for 12 days during stress period i.e. 25-50 days. In treatment T₄, moisture content was below 40 % for 13 days in the stress period of 50-75 days after transplanting. In treatment T₅, moisture content was below 40 % for 18 days. In case of treatment T₆, moisture content was below 40 % level for 13 days. The moisture content of T₆ would have been below 40 % level for period more than 13 days but could not be observed because rain occurred during the stress period. The treatment T₇ was equivalent to control treatment, as there was rainfall during stress period of T₇.

Irrigation water applied

The quantity of irrigation water applied for each treatment is given in Table 2. It is revealed from Table 2 that there is not much difference between irrigation applied in various treatments except T₆. This is due to the application of irrigation at 40 % depletion of available soil moisture during the entire crop period, except stress

Table 2 : The quantity of irrigation water applied (mm), total water applied (mm) and yield of green chilli as influenced by different treatments.

Treatments	Irrigation water applied (mm)	Total water applied (mm)	Yield of green chilli (kg/ha)
T ₁	563.40	687.19	5522
T ₂	552.20	675.99	5122
T ₃	544.50	668.29	4520
T ₄	529.98	653.77	3803
T ₅	495.20	618.99	1795
T ₆	469.50	663.31	3131
T ₇	563.40	689.23	5367
SE ±			44
CD at 5%			130

period. When the stress period over, the treatment was given irrigation to bring the moisture content to field capacity. The quantity of irrigation water applied is less in T_6 as after stress period, irrigation was not applied due to the rainfall.

Total water applied

Total water applied is the sum of irrigation water applied, effective rainfall and moisture consumed from the soil. The values of the total water applied are presented in Table 2 for the different treatments. The total water applied differed by only 10 percent in various treatments.

Yield of green chilli

The yields of the green chilli for different treatments are shown in Table 2. It is observed from that the yields of chilli crop are significantly different. The treatment T_1 is the treatment without stress and treatment T_7 is equivalent to without stress requirement. The yields of the stress treatments T_2 , T_3 , T_4 , T_5 and T_6 are significantly different. Thus for chilli, the yields are significantly reduced, if the stress is offered in preflowering stage (1-25 days) is significantly lower than no stress treatment. The yield of T_2 is significantly lower than T_3 , when stress was applied immediately after the stress period of T_2 . The yield of T_4 is significantly lower than the yield T_3 . Similarly the yield of T_5 is significantly lower than the

yield of all treatments. Yield of T_6 is significantly lower than the all treatments except T_5 . The yield of treatment T_5 is significantly lower than the yield T_6 . However this is not real indication as in treatment T_6 , stress could not be offered during the prescribed period of 25 days due to the rainfall toward the end of the period. In absence of rainfall the yield in treatment T_6 might have been reduced considerably.

It is concluded that if the stress is offered during growth stages of chilli, the yield is reduced significantly and each later stage is more sensitive to the water stress.

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