EFFECT OF DIFFERENT MOISTURE REGIMES ON THE GROWTH AND QUALITY OF GLADIOLUS

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ABSTRACT

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An Experiment was conducted at the floriculture field of Horticulture Research Centre, BARI, Joydebpur during 2003-2004 and 2004-05 to find out the irrigation requirement and a proper irrigation schedule of gladiolus (var. GL-001). Five irrigation schedules were considered viz.; I_0 : no irrigation, I_1 : plant emergence + spike initiation, I_2 : 4 leaves + spike initiation, I_3 : plant emergence + 4 leaves + spike initiation and I_4 : plant emergence + 4 leaves + spike initiation + flower initiation. Irrigation had significant influence on the increase number of spike of gladiolus over control (non irrigated). On the basis of two years result the highest spike yield of gladiolus was recorded with three irrigations applied each at sprouting, 4 leaves and spike initiation stage which was statistically identical to four irrigations each at plant emergence, 4 leaves, spike initiation and flower initiation stage. The lowest spike yield of gladiolus was obtained from control treatment (no irrigation). The highest total water expense (TWE) bearing was in I_4 and the lowest in I_0. The highest water expense efficiency was obtained with non-irrigated (control) treatment (I_0). Soil water depletion was decreased with increased irrigation water.

Key word: Moisture regime, growth and quality, spike initiation, irrigation schedule

INTRODUCTION

Gladiolus (*Gladious sp*) is an important flower crop grown throughout the world. It is popular for its attractive spikes having florets of huge form, dazzling colours, varying sizes and long keeping quality. Gladiolus can be grown in a wide range of soils from a light sandy to a clay loam but deep (at least 30 cm) well drained, friable soil rich in organic matter and nutrients are preferable. For better growth, they require a slightly acidic soil having pH 5.5 to 6.5, where most of the nutrients become available to the plants. If the soil is light, sandy or heavy, adequate amount of well rotten organic materials should be applied and in heavy soils, coarse sand may be added, to improve the texture. For the successful cultivation of this flower, mild climate is ideal while very hot and too cold atmospheric conditions are harmful. The day temperature should range between 15 and 20^{o}C. At the time of planting, the soil temperature should not be less than 10^{o}C (Anon., 1976). The soil should have sufficient moisture at the time of planting of corms so that no watering is required till sprouting. The frequency of irrigation depends largely on the type of soil and prevailing climatic conditions. During warm weather, irrigation twice a week is needed to wet the root zone. In an investigation on the sensitivity of gladiolus to drought in various stages of its development, Halevy (1962) observed that the critical soil moisture content (CM), which decreased yield, differed at various stages of development and according to the condition whereas the crop is grown for flower or corm. When growing for corms, the CM corresponds to the tension at 0.6 to 0.8 atmospheres for the periods from the emergence of the first to the full extension of fifth leaf and from anthesis to the end. Halevy (1972) found two stages of growth sensitive to water stress i) The very early growth stage when flower initiation takes place and ii) from the 4th leaf stage through flower stem elongation.

Robinson (1983) found that water deficit in gladiolus reduced the assimilate mobilizing of the inflorescence, increased that of the corm and delayed translocation from leaves. The water stress decreased the mobilizing ability of inflorescence and increased that of corms, reduced $^{14}CO_2$ fixation and slightly delayed assimilate translocation from the source leaves. In an experiment in Egypt, the yield and quality of flowers were best when the plants were watered at an interval of 12 or 17 days and a minimum soil moisture content of 58 percent field capacity for successful gladiolus culture in sandy clay soil was recommended by El-Gamassy *et al*. 1977, Sasso, 1962, maintaining soil moisture ranges between 20 and 60, 50 and 90 and 80 and 100 percent of field capacity with the help of Bouyoucus soil moisture meter. They recorded nearly the same number of corms in all treatments whereas the number of cormels was slightly increased by increasing soil moisture treatment. The increase in soil moisture content increased the corm diameter and weight.

However, no systematic work is available on water requirement and irrigation scheduling of gladiolus in Bangladesh. Therefore, the present study was undertaken to investigate the water requirement of gladiolus for better flower and corm production as well as to develop a proper irrigation schedule.

Materials and Methods

The experiment was conducted at the floriculture field of Horticulture Research Centre, BARI, Joydebpur during 2003-2004 and 2004 -05 to find out the irrigation requirement and a proper irrigation schedule of gladiolus for better growth and yield. The soil of the experimental plot was Grey Terrace Soil having bulk density 1.5 g cc^{-1}, pH 5.6 and field capacity 38.02 percent by volume. Five irrigation schedules were tested in the study, which were

I_0: Control (no irrigation)
I_1: plant emergence + spike initiation
I_2: 4 leaves + spike initiation
I_3: plant emergence + 4 leaves + spike initiation
I_4: plant emergence + 4 leaves + spike initiation + flower initiation

The experiment was laid out in a randomized complete block design with three replications. The variety used was GL 001. The plot dimension was 1m x 0.9 m. Medium sized corms were planted on November 27 and 25, 2004 and 2005, respectively in lines maintaining row and plant spacing of 25 and 15 cm respectively. The crop was fertilized with 300 kg N ha^{-1} from urea, 55 kg P ha^{-1} from triple super phosphate, 166 kg K ha^{-1} from muriate of potash and 20 kg Mg ha^{-1} from magnesium oxide and 10 t cowdung ha^{-1}. One third of N and whole amount of other fertilizers were applied as basal and the remaining N was applied in two equal splits at 30 and 60 days after sowing. Four weeding were done at 15, 25, 35 and 43 days after sowing. No plant protection measures were taken. As per treatments, irrigations were made with calculated amounts of water required to raise the soil moisture status of the concerned plots up to field capacity. Total water expense was calculated using the water balance equation of Rose (1966) and water expense efficiency was determined according to Cassel *et al.* (1978). Harvesting was started on 24th January and continued up to 20th February in both the years.

RESULTS AND DISCUSSION

On the basis of two years result (2003-2004 and 2004-2005) yield contributing characters like plant height, number of florets/spike, spike length, rachis length, weight of single spike and yield of gladiolus varied due to different irrigation schedules (Table 1).The highest plant height, number of florets $spike^{-1}$, spike length and rachis length were recorded in I_3 which was identical toI_4 and the lowest in I_0 treatment in both the years. Due to irrigation the weight of spikes of gladiolus was increased over control (non-irrigated). The highest single spike weight 51.04 and 51.28g were recorded with three irrigations applied each at sprouting, 4 leaves and spike initiation stage in 2003-2004 and 2004-2005, respectively which was identical to four irrigations each at sprouting, 4 leaves, spike initiation and flower emergence stage. The lowest spike weight 39.92 and 40.04g were recorded with no irrigation in 2003-2004 and 2004-2005, respectively. The spike weight of the treatment I_1 and I_2 were statistically identical which received two irrigations each at sprouting + spike initiation and at 4 leaves + spike initiation stage, respectively. The spike weight of the treatment I_3 and treatment I_4 were also statistically identical. With increased number of irrigation the spike yield of gladiolus increased significantly upto three irrigations. The highest spike yield of gladiolus, 11909 and 12800 kg ha^{-1} were recorded with three irrigations each applied at plant emergence, 4 leaves and spike initiation stage which was statistically identical to four irrigations each applied at sprouting, 4 leaves, spike initiation and flower initiation stage. Significantly the lowest spike yield of gladiolus, 7513 and 8363kg ha^{-1} were obtained from control treatment (no irrigation). However, the spike yield of gladiolus of the treatments I_1 and I_2 were statistically identical which received two irrigations each at plant emergence + 4 leaves and at 4 leaves + spike initiation respectively. The greater water availability in I_3 and I_4 might have facilitated greater root growth and nutrient uptake and thereby produced higher yield of gladiolus than that of other treatments. The marked reduction in spike weight and spike yield in treatment I_0, I_1 and I_2 than that of I_3 and I_4 might be attributed to water stress which might have failed to fulfill the water requirement of the plant and consequently resulted in lower spike weight and spike yield. The total water expense (TWE) by gladiolus varied with the variation of irrigation water applied to the soil. The highest TWE bearing was found in I_4 and the lowest in I_0. The highest water expense efficiency was obtained with non-irrigated (control) treatment (I_0). Soil water depletion was decreased with increased irrigation water (Table-2).

Table 1. Effect of different irrigation schedules on the yield attributes and flower yield of gladiolus during 2003-2004 and 2004-2005

Treat-ment	Plant height (cm)		Spikes/ Plot (no.)		Florets/ spike (no.)		Spike length (cm)		Rachis Length (cm)		Weight of single spike (g)		Spike yield (kg/ha)	
	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-04	2004-2005
I_0	42.23b	42.45b	18.3b	18.81b	7.84c	8.07 c	54.20c	54.23c	28.84c	29.57 b	39.92c	40.04 c	7513 c	8363 c
I_1	47.84a	47.89ab	21.8a	22.14a	10.36ab	10.64 ab	65.35b	64.69b	34.70b	33.95 ab	45.57b	45.60 b	9550 b	11300 b
I_2	46.32ab	47.57ab	21.2a	21.89a	9.18bc	9.20 bc	64.14b	64.87b	32.56b	32.98 b	43.16b	43.17 b	8982 b	10500 b
I_3	49.28a	50.55a	22.5a	22.46a	11.60a	11.51a	73.08a	73.27a	39.40a	39.15a	51.04a	51.28a	11909a	12800a
I_4	48.28a	49.15a	22.5a	22.42a	11.24a	11.32 a	72.52a	69.03ab	38.32a	37.39 a	49.56a	49.68 a	11280a	12370a
CV(%)	4.7	6.01	5.5	5.08	9.5	7.91	4.6	4.99	5.2	9.86	3.6	3.6	6.3	5.62
SE±	1.81	1.67	0.95	0.6190	0.78	0.463	2.45	1.78	1.47	1.97	1.34	1.93	506.79	116.92

Table 2. Water use by gladiolus as affected by different irrigation schedules during 2003-2004 and 2004-2

Treatment	No. of irrigation		Water applied for seedling establishment (mm)		Irrigation water applied (mm)		Rainfall (mm)		Soil water depletion (mm)		Total water expense (mm)		Water expense efficiency kg/ha/mm	
	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005	2003-2004	2004-2005
I_0	0	0	70	55.5	0	0	-	6.20	92.92	88.05	162.20	149.75	46.32	55.85
I_1	2	2	70	55.5	80	100	-	6.20	79.70	75.80	229.70	237.5	41.58	47.58
I_2	2	2	70	55.5	80	111	-	6.20	79.00	74.73	229.00	247.65	39.22	42.40
I_3	3	3	70	55.5	120	144	-	6.20	75.00	70.39	265.00	276.97	44.94	46.21
I_4	4	4	70	55.5	160	200	-	6.20	69.90	68.19	299.90	329.89	37.61	37.50

Two year's result revealed that the application of three irrigations applied each at sprouting, 4 leaves and spike initiation stage at Joydebpur is recommended for better growth and yield of gladiolus.

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